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96
ENGRAVINGS

OF THE

ARTERIES;

ILLUSTRATING

THE SECOND VOLUME

OF THE

ANATOMY OF THE HUMAN BODY,

AND SERVING AS

AN INTRODUCTION

TO THE

SURGERY OF THE ARTERIES.

BY CHARLES BELL.

THE THIRD EDITION.

LONDON:

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TO
SIR CHARLES BLICKE,
PRESIDENT
OF THE ROYAL COLLEGE OF SURGEONS,
SENIOR SURGEON
OF ST. BARTHOLOMEW'S HOSPITAL,
&c. &c. &c.

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ENGRAVINGS
OF
THE ARTERIES.

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London, 34, Soho Square.

PREFACE

TO THE

FIRST EDITION.

To facilitate the acquisition of the leading principles ought to be the first object of an elementary book ; and most of all ought we to study simplicity in a work treating of Anatomy. When the way is smoothed, the student feels a rapid progress, and is pleased with his own exertions ; and it requires only a little self-examination to be assured that much of our partiality for any particular line or object of study, often results from a real or fancied superiority of knowledge ; perhaps in Anatomy, more than in any other pursuit, it is necessary to make the student sensible of his progress, before he can feel any thing like enthusiasm, or even partiality for it.

It is upon the simplicity of these Plates, therefore, more than upon their elegance, or their accuracy, (though I am confident that in

this last respect they are not deficient,) that I would place their merit. When the importance of the study of the Arteries is considered—a point so fully enforced and illustrated in the volume of the text to which I mean these plates to be attached—this book must, I think, be an acquisition to the student, since I am conscious that I should myself have found it to be so in the commencement of my studies; it is with this feeling that I offer it with confidence to the public. I am assured, also, that the study of the Blood-vessels and Nerves from Plates, prepares us better for undertaking any surgical operation than that of bare description, however accurate, however simple, or however constantly the true practical inferences may be kept in view. It is upon the eye that the impression must be made, which is to enable us, in looking upon a limb, to mark the course of the Arteries: Drawings are a kind of notes, too, more easily consulted; and bring to the mind, in a more lively manner, all that was associated in our first studies.

IN following the course of the Arteries, we must have continual occasion to observe, that if one branch deviate from the more general

course, or be of an unusual size, the neighbouring branches have also an unusual form. In the arteries of the arm, for example, were we to observe the great Thoracic Artery of an uncommon size, and sending large branches under the Latissimus Dorsi, and under the Scapula; were we to take our drawings of this Artery as an example of a beautiful distribution of the external Mammary Artery, without attending to the effect of such distribution on the Subscapular Artery; or again, were we to draw the Subscapular Artery of the great comparative size which it not unfrequently takes; we should not give a just representation of the natural and most usual distribution of those arteries: for, as we find that the distribution of the Thoracic Arteries materially affects the distribution of the Articular Arteries and of the Profunda, although it be absolutely necessary in the text to describe the size and importance of this Artery, because in our operations at this part we must keep in view the more dangerous and unfavourable circumstances, it does not follow that we are to make our drawings by the same rule; we should by doing so make them monstrous and unnatural.

WE thus see the necessity of combining drawing with description. In the latter we mark all the variety of distribution, and the peculiarities of each branch considered individually; but this again naturally produces intricacy, unless, by comparison with the drawings, and their short explanations, we can take a rapid and general view of the course of the vessels. The drawings ought, therefore, to give the representation of the more general distribution, while the varieties and peculiar forms are left to description. And here comes a question of some consequence—How is a selection from the great variety of distribution of the vessels and nerves of the body to be made?

I CANNOT agree with the opinions most prevalent regarding Anatomical Tables, that it is impossible to make a true representation of the parts from any individual body; for, as we see, in looking over the variety of Anatomical Tables, that those which have the characters of the parts distinctly marked, and have been evidently drawn from the parts dissected and laid out before the artist, are in greatest esteem for the accuracy of the anatomy, and best bear the only true test of

excellence, the immediate comparison with the subject in the dissecting room ; so, on the other hand, those made by first drawing the outlines of the parts, and then the vessels, are plans merely, in which the character of the parts, and the peculiar course and turnings of the vessels, are lost. Indeed I suspect that it has been from a want of knowledge of drawing that the system of composing plans of the anatomy, instead of making accurate drawings, has obtained so generally.

But I hope I shall not be understood to say, that if a drawing be made accurately from the subject, it will therefore answer all the purposes required. Of twenty bodies, not one, perhaps, will be found fit for drawing ; but still I conceive that we are not to work out a drawing by piecing and adding from notes and preparations ; we are to select carefully from a variety of bodies, that which gives largeness of parts, where the characters of parts are well marked, and where there is the most natural and usual distribution of vessels. In making our drawings of such dissections, let us allow ourselves no licence, but copy accurately. By noting in the description any little deviation, every necessary end is answered.

I HOPE that I have been able to make these Plates simple, intelligible, and accurate. While the design of this book of Plates is to present to the student, at one glance, the general distribution of the vessels, and to fix them in his memory in a way which no description can accomplish, it will be found to give the most usual distribution of the branches; for I have been careful in the selection of my subjects.

IN studying the Arteries, or any part of Anatomy, we should, in the first place, run the eye over the corresponding plate, then read the general description in the text; and lastly, proceed to study more closely, step by step.

I KNOW the difficulties which the student must encounter in acquiring a comprehensive knowledge of the nerves; the books on that subject being more confused and intricate to study, than the most irregular dissection. The next part, therefore, of this work, comprehends the NERVOUS SYSTEM, though the present book I conceive to be complete in itself.

PREFACE

TO THE

THIRD EDITION.

IN this edition, I trust I have shewn my regard for the approbation of the public, already bestowed upon this little work, by endeavouring to improve it.

I HAVE added a Plate of the Aortic System, by my young friend and pupil, Mr. Charles Cheyne, whose steady pursuit of that science to which I am devoted, has gained my esteem and confidence. I have added some other Plates, and I have etched most of the Plates with my own hand, preferring accuracy to elegance. I have often had to regret in the former editions of my work, that my intentions were entirely mistaken by the publishers and the artists employed.

I HAVE also added, in foot-notes, some schemes of arrangement of the more intricate branches.

THE most essential addition, however, which I have made, is the introduction of some rules for cutting down upon the Arteries, in cases of dangerous bleedings. They were taken by a pupil, from my public lectures on the Arteries, while I had the subject before me, and was describing and measuring the depth of parts, previous to entering upon the rules deducible from the projecting points of bone, and the course of the tendons and muscles in the living body.

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Fig. I.

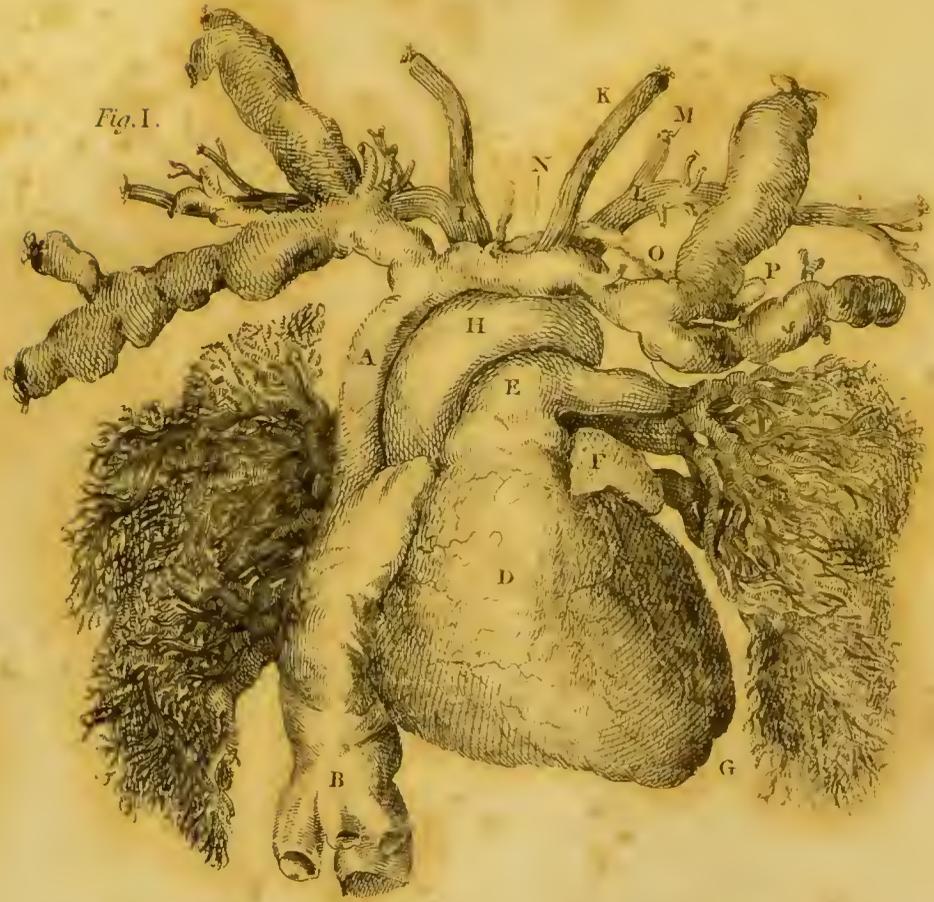
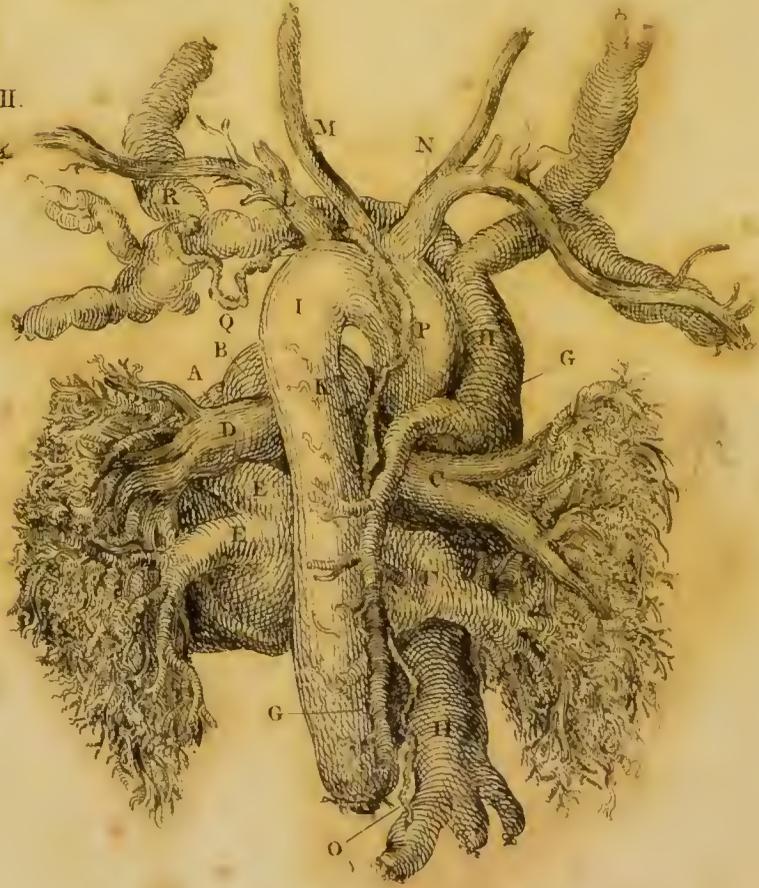


Fig. II.



EXPLANATION

OF

PLATE I.

FRONT AND BACK VIEWS OF THE HEART.

FIG. I.

A View of the Heart, nearly in the Situation in which it is seen when the Breast is opened.

- A. The SUPERIOR VENA CAVA, returning the blood from the head and arms.
- B. The INFERIOR CAVA, where it pierces the diaphragm to convey the blood from the lower parts of the body into the right auricle. The three vessels which join the Cava here are the *Venæ Cavæ Hepaticæ*.
- C. The RIGHT SINUS, or AURICLE.
- D. The RIGHT VENTRICLE.

B

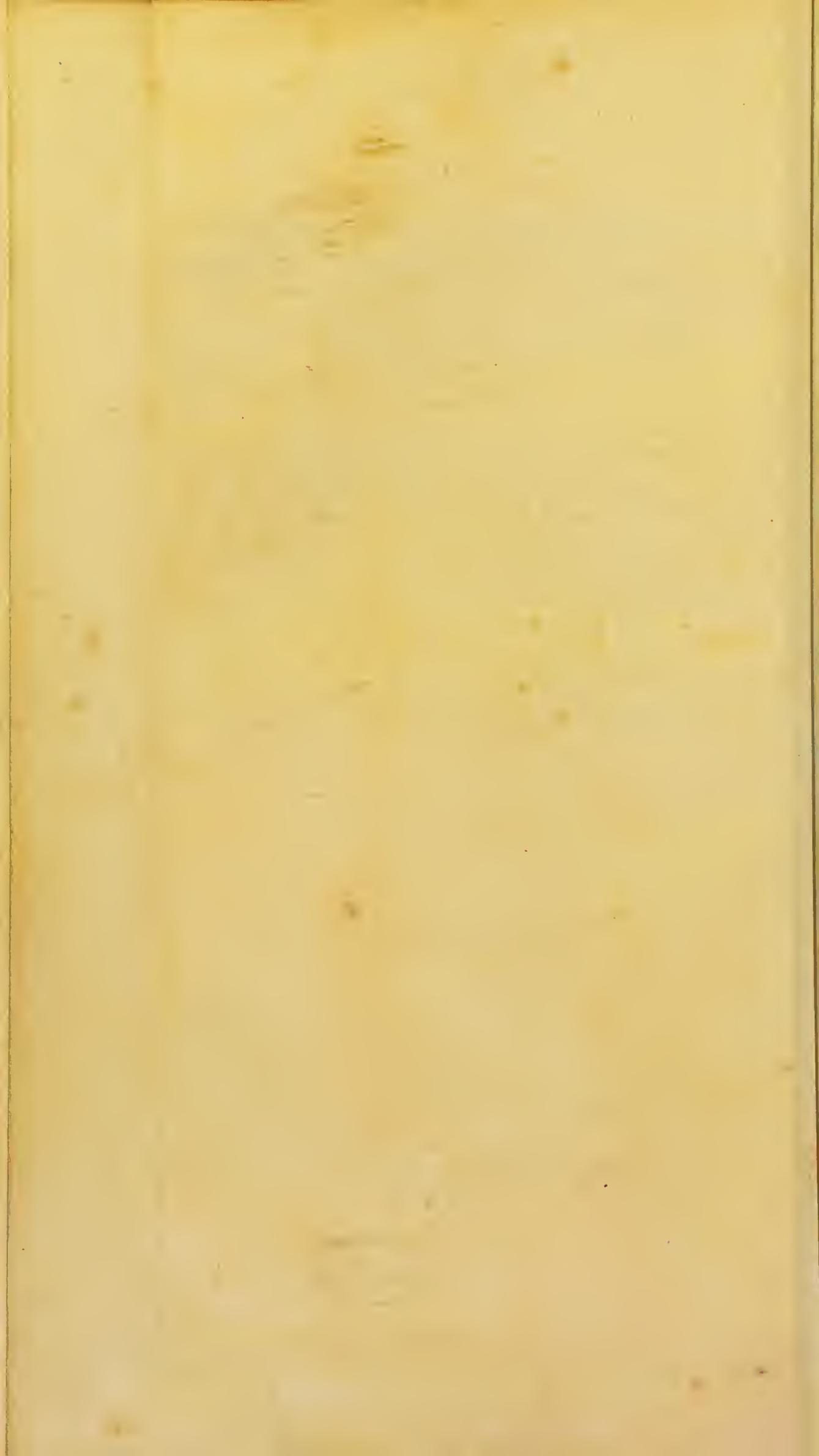
- E. The PULMONARY ARTERY ; it is seen to divide ; one branch to pass under the arch of the aorta, to the lungs of the right side ; the other to take an acute turn to those of the left side.
- F. Part of the Left Sinus of the heart, or that which is properly the auricle.
- G. The LEFT VENTRICLE ; it is seen Fig. II. A.
- H. The Arch of the AORTA.
- I. The Arteria Innominata giving off the SUBCLAVIAN and CAROTID of the right side.
- K. The CAROTID ARTERY of the left side.
- L. The SUBCLAVIAN ARTERY of the left side.
- M. The VERTEBRAL ARTERY of the same side.
- N. The THORACIC DUCT where it lies near the arch of the Aorta, and behind the root of the great arteries.
- O. The THORACIC DUCT where it passes across the root of the neck.
- P. The Termination of the THORACIC DUCT in the union of the Subclavian and Jugular Veins.

FIG. II.

Back View of the Heart and Vessels.

- A. The LEFT VENTRICLE of the Heart.
- B. The Trunk of the PULMONARY ARTERY.
- C. The Right Branch of the Pulmonary Artery.
- D. The Left Branch of the Pulmonary Artery.
- E.E. The Pulmonary Veins of the left side, entering the left sinus of the heart.
- F. The Pulmonary Veins of the right side.

- + G.G. The *VENA SINE PARI*, or *AZYGOS*; this vein lies upon the spine, collects the blood from the back part of the thorax, and conveys it to the superior vena cava.
- H. The *SUPERIOR* and *INFERIOR VENÆ CAVÆ*.
- I. The *Aorta*, where it first touches the spine.
- + K. One of the *Bronchial Arteries*, going to supply the lungs.
- L. The *LEFT AXILLARY ARTERY*.
- M. The *LEFT CAROTID ARTERY*.
- N. The *ARTERIA INNOMINATA*, or common origin of the subclavian and carotid arteries of the right side.
- + O. The *THORACIC DUCT*, where it lies upon the spine and near the *AORTA*.
- P. The *THORACIC DUCT*, where it has ascended.
- Q. The same duct, now the principal trunk of the absorbent system, where it lies betwixt the root of the arteries to the head and arms and the branch of the Superior Cava.
- R. The trunk of the Absorbents entering the left Subclavian Vein.





L.

M.

EXPLANATION

OF THE

PLATE OF THE AORTIC SYSTEM.

PLATE II.

<i>Principal Divisions of the Arteries.</i>	<i>Branches of the Arteries.</i>
A. VALVES of the AORTA.	
B. The ASCENDING AORTA	{ 1. The Left Coronary Artery. 2. The Right Coronary Artery.
C. The ARTERIA INNOMINATA.	
	{ 1. The Vertebral Artery. 2. The Internal Mammary. 3. The lower Thyroid Artery. 4. The ascendant Branch of the Thyroid.
D.D. The SUBCLAVIAN ARTERIES	{ 5. The Transversalis Colli. 6. The Transversalis Humeri. 7. The first and second Intercostals. 8. The Suprascapularis.

*Principal Divisions of the
Arteries.*

Branches of the Arteries.

E.E. AXILLARY ARTERY	<ul style="list-style-type: none"> 1. Superior Thoracic Artery. 2. Thoracica Longior. 3. Thoracica Humeraria. 4. Subscapularis. 5. Circumflexa Posterior. 6. Circumflexa Anterior.
F.F. The BRACHIAL ARTERY*	<ul style="list-style-type: none"> 1. Profunda Humeri Superior. 2. Anastamoticus Major.
G. The RADIAL ARTERY	<ul style="list-style-type: none"> 1. Recurrens Radialis Anterior. 2. Arteria Superficialis Volæ. 3. Arteria Palmaris Profunda.
H. The ULNAR ARTERY	<ul style="list-style-type: none"> 1. Recurrens Ulnaris Anterior. 2. Recurrens Ulnaris Posterior. 3. Arteria Dorsalis Ulnaris. 4. Arteria Palmaris Profunda.
I. INTEROSSEOUS ARTERY	<ul style="list-style-type: none"> 1. Interossea Superior Perforans. 2. Recurrens Interossea.
K. CAROTID ARTERY.	
L. EXTERNAL CAROTID	<ul style="list-style-type: none"> 1. Arteria Thyroidea Superior. 2. Arteria Lingualis. 3. Arteria Labialis or Facialis. 4. Arteria Occipitalis. 5. Posterior Auris. 6. Arteria Maxillaris Interna. 7. Arteria Transversalis Faciei. 8. Arteria Temporalis.
M. INTERNAL CAROTID	<ul style="list-style-type: none"> 1. Arteria Anterior Cerebri. 2. Arteria Media Cerebri. 3. Arteria Communicans.

* On the left side there is a high bifurcation of the artery.

*Principal Divisions of the
Arteries.*

Branches of the Arteries.

N. VERTEBRAL ARTERY	{ Arteria Cerebelli Posterior and Anterior.
O. BASILAR ARTERY	{ 1. Arteria Communis. 2. Arteria Cerebri Posterior.
P. THORACIC AORTA	1 2 3 4 5 6 7 8 9 10 Art. Intercostales.*
Q. ABDOMINAL AORTA	{ 1. Arteria Phrenica.
	{ 2. Arteria Cæliaca. { 3. Coronaria Ventriculi.
	{ 4. Arteria Hepatica.
	{ 5. Arteria Splenica.
	{ 6. Mesenterica Superior.
	{ 7. Arteriæ Capsulares.
	{ 8. Arteriæ Emulgentes.
	{ 9. Arteriæ Spermaticæ.
	{ 10. Mesenterica Inferior.
	{ 11. Arteriæ Lumbares.
	{ 12. Arteria Media Sacra.
	R. COMMON ILIAC ARTERY.
S. INTERNAL ILIAC	{ 1. Arteria Obturatoria.
	{ 2. Arteria Glutea.
	{ 3. Arteria Ischiatica.
	{ 4. Arteria Pudica.
T. EXTERNAL ILIACS	{ 1. Arteria Epigastrica.
	{ 2. Circumflexa Ilii.
U. FEMORAL ARTERY	{ 3. Profunda Femoris { 1. Circumflexa Externa.
	{ 2. Circumflexa Interna.
	{ 3. Perforantes.

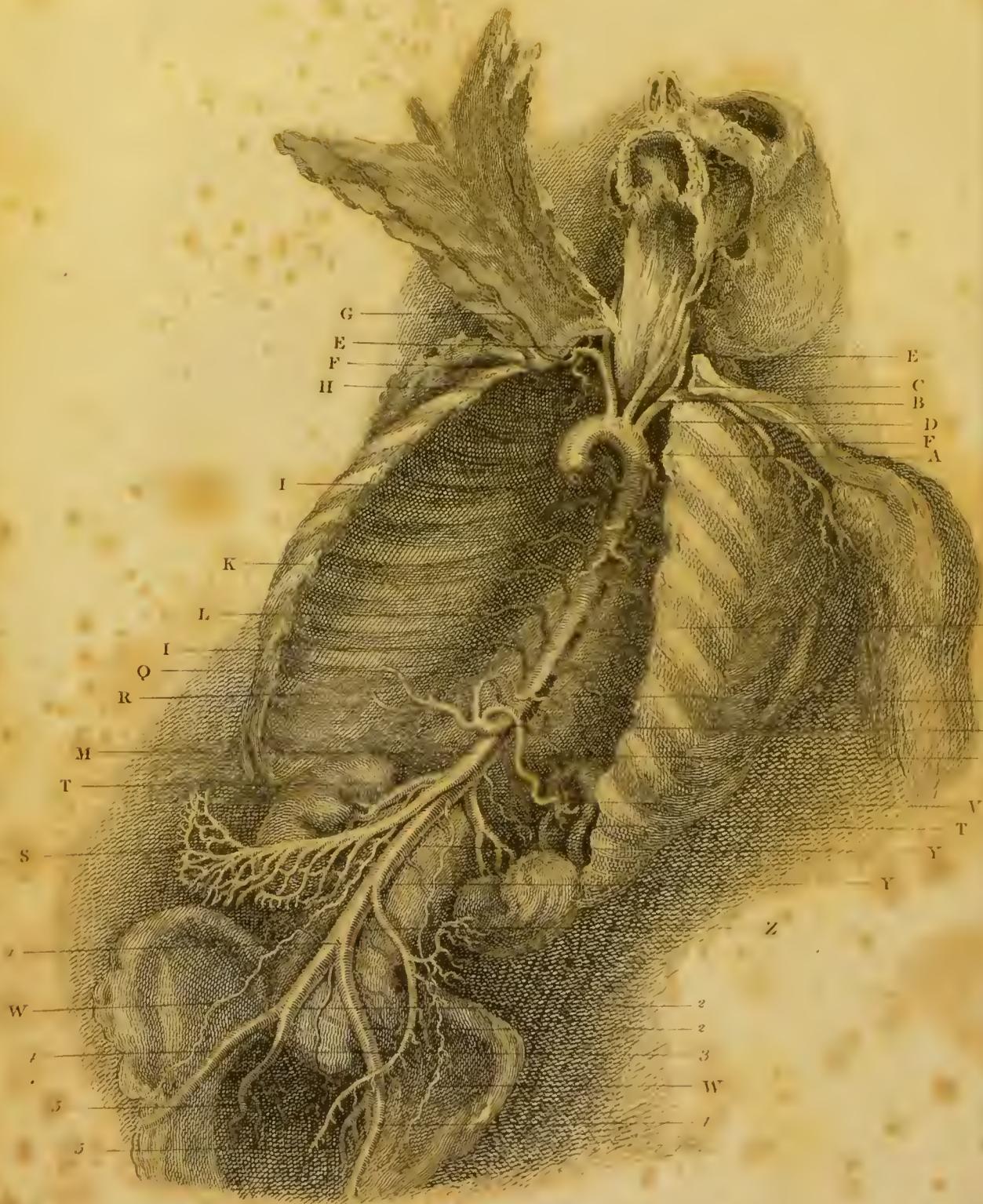
* The Aorta, when it is behind the root of the lungs, gives three or four arteries to nourish their substance, called Bronchial Arteries. Lying beside the Œsophagus, also, it gives to it a few arteries, the Œsophageal Arteries.

*Principal Divisions of the
Arteries.*

Branches of the Arteries.

v. POPLITEAL ARTERY	{ 1. Arteria Articularis Superior Externa. 2. ————— Interna. 3. ————— Media. 4. ————— Inferior Externa. 5. ————— Interna.
w. ANTERIOR TIBIAL ARTERY	{ 1. Recurrens Tibialis Antica. 2. Malleolaris Interna.
x. POSTERIOR TIBIAL ARTERY	{ 1. Plantaris Externa. 2. ————— Interna.
y. FIBULAR ARTERY.	





Drawn by C. Bell.

Etched by J. Stewart.

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EXPLANATION

OF

PLATE III.

- A. ARCH of the AORTA.
 B. ARTERIA INNOMINATA.
 C. ——— CAROTIS COMMUNIS SINISTRA.
 D. ——— SUBCLAVIA.
 E. ——— VERTEBRALIS.
 F. ——— AXILLARIS.
 G. ——— MAMMARIA INTERNA.
 H. ——— INTERCOSTALIS SUPERIOR.
 I.I. ——— AORTA THORACICA.
 K. ARTERIÆ ÆSOPHAGEÆ.
 L.L. ——— INTERCOSTALES INFERIORES.
 M. ABDOMINAL AORTA.
 N. ARTERIÆ PHRENICÆ.
 O. ARTERIA CÆLIACA.
- Branches of the CÆLIACA {

 P. Arteria Splenica.

 Q. — Coronaria Superior Ven-

 triculi.

 R. — Hépatica.

S. MESENTERICA SUPERIOR.

T. ARTERIÆ EMULGENTES.

V. ——— CAPSULARES.

W.W. ——— SPERMATICÆ.

Y. ARTERIA MESENTERICA INFERIOR.

Z. One of the Lumbar Arteries.

1. Bifurcation of the Aorta.

2.2. Arteriæ Illiacæ Communis.

3. ——— Sacra Media.

4.4. ——— Illiacæ Externæ.

5. Ramifications of the internal Iliac Artery.





ARTERIES OF THE HEAD.

EXPLANATION

OF

PLATE IV.

FINDING in the head of this black the most common and regular distribution of the branches of the Carotid Artery, I took this sketch from it. It is an etching, without a touch of the graver. The appearance of the eye and mouth is neither like the living or the dead, but those accustomed to anatomy will perhaps recognise the turgescence of the Injected Head.

The neck and part of the face is dissected.

- A. The TRACHEA, or windpipe.
- B. Muscles of the fore part of the Throat, viz. *Sterno-Hyoideus* and *Sterno-thyroideus*.
- C. The THYROID GLAND.*

* *Thyroid Gland.* This is one of the glandular bodies the nature and function of which we are entirely ignorant. But it is important to know that it swells with the irregularities of the female system; that it is often enlarged and yet harmless; that it is the seat of the Goitres; that it is sometimes scirrhus and hard, and the cause of suffocation.

- D. The *Digastricus* or *Biventer Maxilla Inferioris*. This double-bellied muscle is preserved here to mark the relation of the principal branches of the external Carotid Artery.
- E. The PAROTID GLAND: it is dissected back from the jaw, to shew the course of the Artery.
- F. The muscle *Sterno-Cleido-Mastoideus*.
- G. An Enlarged Lymphatic Gland, of the cluster called *Concatenata*.
- H. The *Masseter* Muscle.
- I. The Duct of the Parotid Gland cut across.

ARTERIES.

- 1. CAROTIS COMMUNIS. This, the Common Carotid Artery, gives off no small branches, but divides near the angle of the jaw.
- 2. CAROTIS INTERNA or CEREBRALIS.* This Internal Carotid Artery makes so sudden an angle here, that it is indeed (especially when injected) the most superficial of the two grand divisions.
- 3. CAROTIS EXTERNA SUPERFICIALIS. This External Carotid Artery divides into seven principal branches, which now follow:
- 4. ARTERIA THYROIDEA. The branches of the Thyroid Artery are these:
 - 5. Thyroidea propria.
 - 6. Laryngea, to the epiglottis, and muscles of the arytenoid cartilage.
 - 7. Superficialis, muscularis, viz. to the sternocleido mastoideus, to the sternohyoidei, and thyroidei, to the thyro-hyoideus.

* *Carotis Interna* lacerated. *Surgical Observations by Mr. Abernethy.*

8. **ARTERIA LINGUALIS.** The Artery of the Tongue lying deep, and in shadow, I cannot put letters on its branches, which are these :

{	Sublingualis.
	Dorsalis linguæ.
	Ranina.
	Branches irregularly to the muscles of the tongue and pharynx.

9. **ARTERIA FACIALIS.** See the succeeding plate 1.
10. The *Submentalis*, a branch of the last.
11. The continued trunk of the **EXTERNAL CAROTID ARTERY.**
12. The **ARTERIA MAXILLARIS INTERNA.** Going behind the lower jaw. See 10 of the succeeding plate.
13. The **ARTERIA TRANSVERSALIS FACIEI.**
14. The **ARTERIA TEMPORALIS.**
15. The **OCCIPITALIS.**



Fig. 1.



Fig. 2.



ARTERIES OF THE HEAD.

EXPLANATION

OF

PLATE V.

IN this Plate the Arteries of the FACE are further prosecuted.

Fig. I. a Dissection of the Face.

- A. The SUBMAXILLARY GLAND.*
- B. A Lymphatic Gland, which is constant in place, lying near the Submaxillary Gland, and close upon the facial artery.

* *Submaxillary Gland.* This is a Salivary Gland, and of course associated with the Parotid Gland, C. As the nature of tumours in this part is often a subject of consultation, the dissector ought carefully to attend to its relations. He finds near it the facial artery, covered by the *Platysma Myoides*, a thin cutaneous muscle; but he has especially to observe the place of the Lymphatic Gland, B, which is so much more frequently diseased than the Salivary one. I have had to cut out this Lymphatic Gland, and know its appearance in this state. I have assisted a friend in the same operation, when he was convinced, (and insisted upon it,) that he was extirpating the Submaxillary Gland. See what is said *System of Dissections*, vol. ii. p. 245, 250.

- c. The PAROTID GLAND, the largest of the Salivary Glands.
It is seen here to rise before the ear, and to stretch down betwixt the mastoid process of the temporal bone and the jaw-bone.*
- d. The SOCIA PAROTIDIS, a small gland of the Salivary kind, which adds its duct to that of the Parotid Gland.
- e. The DUCT of the PAROTID GLAND, which passes through the buccinator muscle, and opens into the mouth.†
- f. The Masseter Muscle.

ARTERIES.

1. The ARTERIA FACIALIS, mounting over the base of the lower jaw-bone.‡ After this its branches are :
- | | |
|---|--|
| { | 2. To the Masseter. |
| | 3. <i>Coronaria labii inferioris</i> .§ |
| | 4. <i>Coronaria labii superioris</i> . |
| | 5. <i>Nasalis lateralis</i> . |
| | 6. <i>Angularis</i> inosculating with the ophthalmica. |

* *Parotid Gland*. Observe also that sometimes there is found lying on the parotid, or in its substance, a lymphatic gland, which may be diseased, and which I have seen diseased, and taken out from its socket in the gland. We ought also to attend to the vessels passing through the parotid gland, particularly the continued branch of the external carotid, the going off of the internal maxillary, and the transversalis faciei. (See Fig. II.) We shall be convinced from the actual view of the parts, that with the knife, it is impossible to extirpate the parotid gland. *System of Dissections*. The gland and duct represented in *Cooper's Myotomia*, tab. xxii. c.c.d.

† *Parotid Duct*, or Steno's Duct, from the discoverer. More attention ought to be paid to the situation of this duct than to the arteries of the face; for if cut by accident, or in operation, it forms a most troublesome salivary fistula. See *Operative Surgery*, vol. ii. p. 26.

‡ *Facial Artery*, or *Labialis*, or *Maxillaris Externa*, or *Angularis*, often tortuous before rising over the jaw. *Haller Icon. Arter: Cap: tab. ii. E. iii. 28. Cooper's Myotomia*, plate XXII. o.o.o. The artery is not in its place at F, tab. xxiii. This artery left untied in operation, almost suffocating the patient afterwards. See *Abernethy's Surgical Observations*.

§ A very small branch of the internal maxillary artery (fig. 2.) comes

7. *ARTERIA TRANSVERSALIS FACIEI.* Coming from under the Parotid Gland, and supplying the muscles and fat of the cheek.*
8. *ARTERIA OCCIPITALIS.*† Tortuous, as all the arteries are which rise on the head. The branches are :
- | | |
|---|----------------------------|
| } | Meningea. (not seen here) |
| | 9. Cervicalis descendens. |
| | 10. Vertebralis. |
| | 11. Auricularis. |
| | 12. Occipitalis ascendens. |
13. *ARTERIA TEMPORALIS.*
14. *Temporalis Anterior.*
15. *Temporalis Posterior.*‡

out through the mental foramen and inosculates here, with the facial artery. See *Hal. Icon. tab. Faciei Arter.*

* *Transversalis Faciei.* This is sometimes a more considerable artery, and eneroaches on the office of the *Facialis*. It is here a little raised from its place, and ought to have been nearer the Parotid Duct. This artery I have seen bleed very smartly. In cuts of the face, when either this or any of the other arteries of the face are opened, we have only to use the twisted suture, taking care to pass the needle so near the bleeding orifice that it may receive the full operation of the thread when twisted round the needle or pin ; this secures the artery, and at the same time brings the lips of the wound neatly together. See *Operative Surgery.*

† OF THE EXACT PLACE OF THE OCCIPITAL ARTERY.

The occipital artery is found immediately under the mastoid process ; from under the insertion of the mastoid muscle it runs backwards, on a level with the tip of the ear, under the insertion of the trapezius, and, of course, under the superior transverse ridge of the occipital bone. On the side of the neck, the internal jugular vein is immediately under it ; it is under the origin of the digastricus muscle.

‡ *Temporalis*, the superficial branches are two in number, viz. the anterior and posterior, the middle also arises from this, but is under the fascia ; and the deep Temporal is a branch of the *Arteria Maxillaris Interna.*

16. *Palpebralis* a branch of the *Ophthalmica Cerebralis*.
17. *Frontalis*, a branch of the *Ophthalmica Cerebralis*.
18. *Infra-Orbitalis*, a branch of the *Maxillaris Interna*.

FIG. II.

Showing the course of the Internal Maxillary Artery. The lower jaw is taken away, the Parotid Gland raised up, and the dissection of the External Carotid Artery prosecuted.

- A. The Palate.
- B. The Parotid Gland dissected back.
1. The COMMON CAROTID ARTERY.
2. The THYROID, the first branch of the External Carotid.
3. The LINGUAL and FACIAL ARTERIES, coming off together.
4. The continued trunk of the EXTERNAL CAROTID.
5. The PHARYNGEAL ARTERY.
6. The INTERNAL CAROTID ARTERY.*
7. The ANTERIOR ARTERY of the EAR.
8. The TRANSVERSE ARTERY of the FACE.
9. The TEMPORAL ARTERY.
10. The INTERNAL MAXILLARY ARTERY.

* *Internal Carotid*. In Dr. Hooper's collection of preparations there is a curious example of the ulceration of this artery. A man intending to destroy himself, attempted to swallow pins tied together; they stuck in the pharynx, and in time penetrated to this artery, which suddenly cut him off.

The principal branches of the ARTERIA MAXILLARIS INTERNA, are the following :

- 11. *Aa. Maxillaris Inferior.**
- 12. *Temporalis Profunda.*
- 13. *Meningea Media.†*
- 14. *Alveolaris, (to the upper jaw.)*
- 15. *Infra Orbitalis.*
- 16. *Buccalis.*
- 17. *Nasalis.‡*

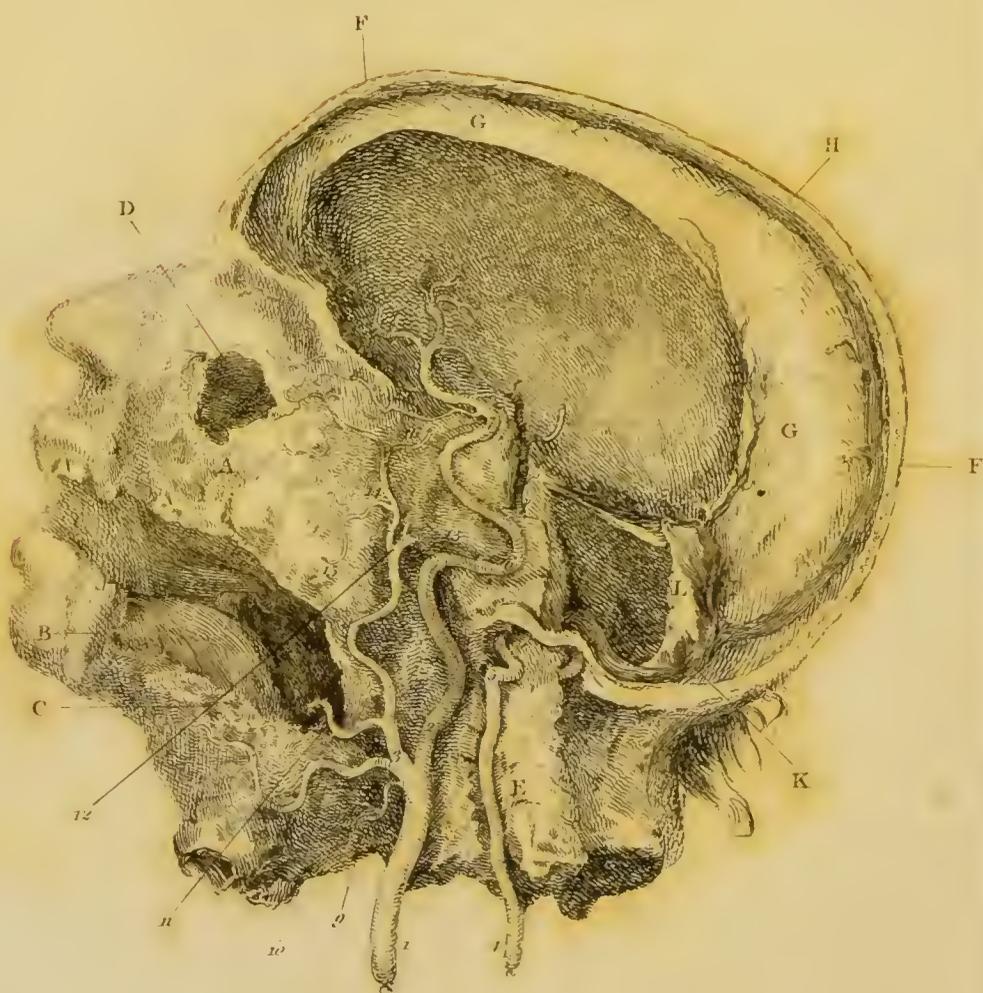
* *Maxillaris.* This artery enters at the posterior foramen of the lower jaw-bone, and courses within the bone, and appears on the chin, coming out through the mental foramen. See what is said on the bleeding of small arteries from bone, in my *Operative Surgery*. In pulling the last Molaris of the Lower Jaw, if the inner plate of the bone be broken off, and this artery torn up among the cells of the bone, the patient may die of bleeding.

† *Meningea.* This artery enters the skull by the foramen spinale of the sphenoid bone, and is the same that makes the deep furrow in the inside of the Parietal Bone. See Remarks, *Principles of Surgery*, vol. ii. part ii. p. 298. Mr. Walker of Edinburgh communicated to me a case where an arrow shot into the skull wounded this artery.

‡ *Nasalis.* This artery being a principal one of the exposed Vascular Membrane of the nose, bleeds profusely in cachexies, when a little blood lost may be full of danger. Of the manner of stopping this hæmorrhagy from the nose, see *Operative Surgery*, vol. i.







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EXPLANATION

OF

PLATE VI.

*Being a View of the Course of the Internal Carotid Artery,
and the Vertebral Artery, as seen upon making a vertical
Section of the Head.*

FIG. I.

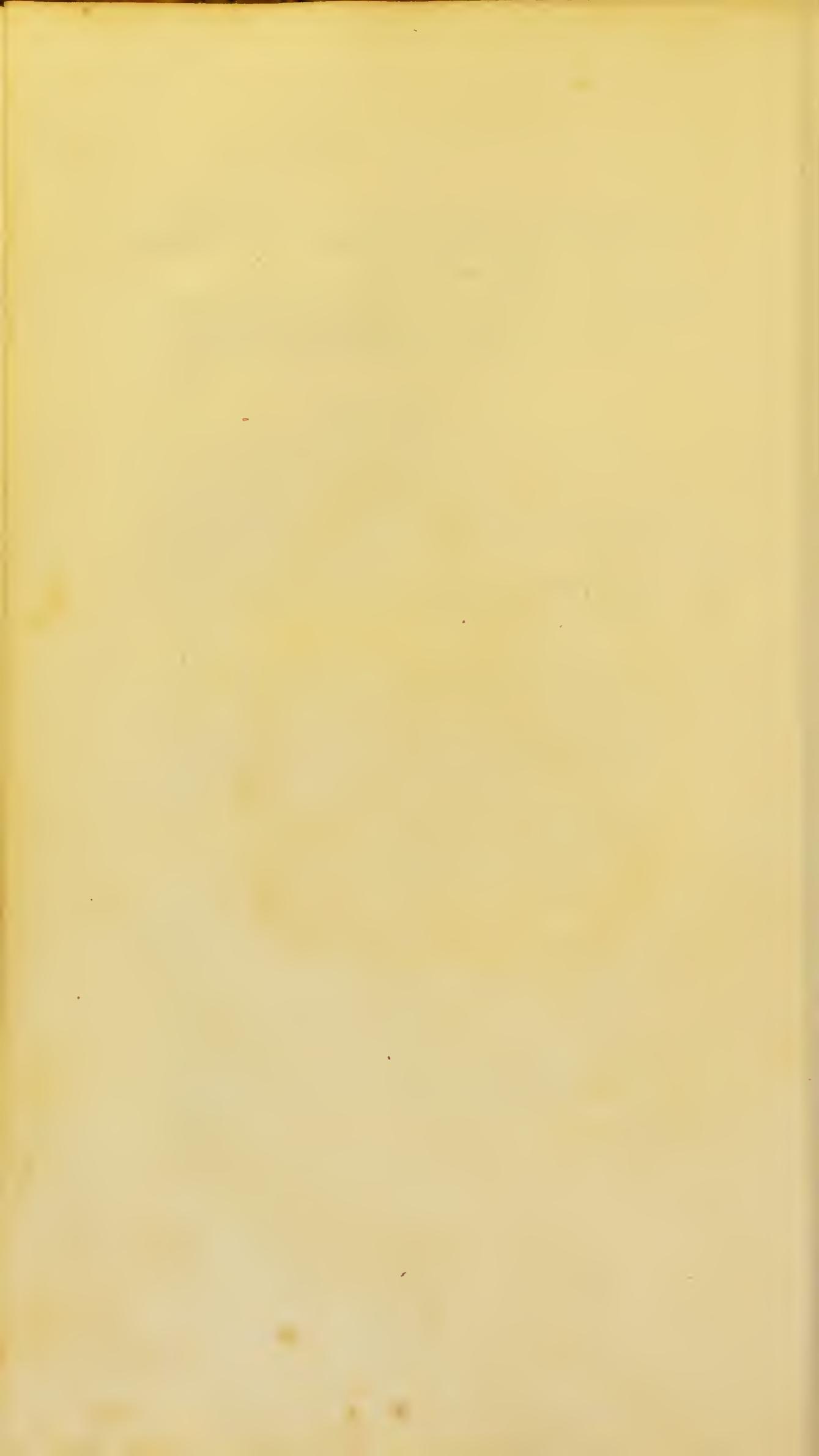
- A. The Upper Jaw Bone ; part of it is torn away.
- B. The Lower Jaw Bone ; all the angle of the right side is taken away.
- C. The Tongue.
- D. The Antrum Highmorianum, torn open.
- E. The Vertebræ of the Neck, cut to show the passage of the artery, encased in the bones
- F. F. The Scull-cap, sawn through parallel to the longitudinal sinus.
- G. The Falx, which divides the hemispheres of the Brain.

- H. The Longitudinal Sinus.
- I. The Fourth Sinus, returning the blood from the lower sinus of the falx, and from the vena Galeni.
- K. Right Lateral Sinus.
- L. The Tentorium, which covers the cerebellum, and supports the posterior lobes of the cerebrum.

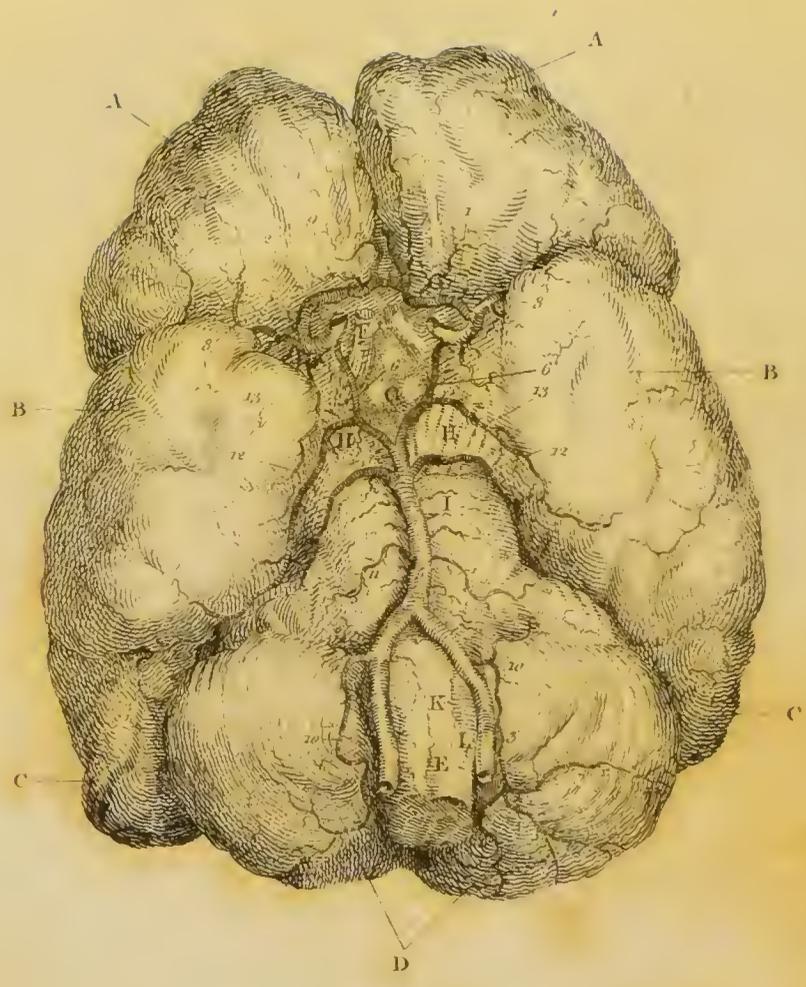
ARTERIES.

1. The COMMON CAROTID ARTERY.
2. The INTERNAL CAROTID ARTERY.
3. The EXTERNAL CAROTID ARTERY.
4. The VERTEBRAL ARTERY; the processes of the vertebræ being cut away.
5. The last and violent turn of the Vertebral Artery, before entering the foramen magnum of the occipital bone.
6. The violent contortions of the Internal Carotid Artery, before entering the skull.
7. The point of the Internal Carotid Artery, where, after making its turns in its passage through the bone, it appears by the side of the sella Turcica.
8. The OPHTHALMIC ARTERY, derived from the carotid. It is this artery which is seen to inosculate with the Facial Artery, in the preceding Plate, at 17. fig. 1.
9. The THYROID ARTERY.
10. The LINGUAL ARTERY.
11. The FACIAL ARTERY cut short; it is seen in the 4th Plate, fig. 9, passing over the jaw.
12. The Continued Trunk of the External Carotid Artery; it is about to divide into the temporal and internal maxillary arteries. See the preceding Plate, fig. 2. (10.)
13. The TEMPORAL ARTERY, cut short.

14. The INTERNAL MAXILLARY ARTERY.
15. That Branch of the Internal Maxillary Artery, which passes into the lower jaw.
16. The GREAT or MIDDLE ARTERY of the DURA MATER; a branch of the internal maxillary.







Drawn by C. Bell

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EXPLANATION

OF

PLATE VII.

ARTERIES OF THE BRAIN.

DIVISIONS OF THE BRAIN.

- A. A. The Anterior Lobes of the Cerebrum.
- B. B. The Middle Lobes of the Cerebrum.
- C. C. The Posterior Lobes of the Cerebrum, which rest upon the tentorium.
- D. The Right and Left Lobes of the Cerebellum.
- E. The MEDULLA OBLONGATA.
- F. The OPTIC NERVES, cut at their union.
- G. The CORPORA ALBICANTIA; the INFUNDIBULUM is seen betwixt these and the optic nerves.
- H. H. The CRURA CEREBRI.
- I. The PONS VAROLII, or Tuberculum Annulare.

- κ. The Eminences of the Medulla Oblongata, called **CORPORA PYRAMIDALIA**.
 λ. The **CORPORA OLIVARIA**.

ARTERIES.

- 1, 2. The Right and Left Carotid Arteries, raised with the brain, and cut off as they rise at the point marked in the preceding Plate (7.), that is, as they rise by the side of the sella Turcica.
- 3, 4. The Right and Left **VERTEBRAL ARTERIES**.
5. The union of the Vertebral Arteries to form the **BASILAR ARTERY**.
6. The Communicating Artery, or Anastomosis, betwixt the Basilar Artery and Carotid.
7. The Union of Communication betwixt the carotids of each side by the anterior artery of the cerebrum; these anastomosis 6 and 7 form the **CIRCLE OF WILLIS**.

DIVISIONS OF THE INTERNAL CAROTID ARTERY.

8. The **MIDDLE ARTERY OF THE BRAIN** passing into the **FISSURA SILVII**.
9. The **ANTERIOR ARTERY** of the **CEREBRUM**.

BRANCHES OF THE VERTEBRAL AND BASILAR ARTERIES.

10. The **POSTERIOR ARTERY** of the **CEREBELLUM** from the Vertebral Arteries.

11. A very considerable branch of the Basilar Artery to the pons Varolii and cerebellum, which however has no name.
12. The ANTERIOR ARTERY of the CEREBELLUM.
13. The Posterior Artery of the Cerebrum.

The lesser branches of vessels seen in this Plate are not distinguished by any particular name.







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EXPLANATION

OF

PLATE VIII.

THE ARTERIES OF THE ARM.

- A. The CLAVICLE.
- B. The CORACOID PROCESS of the Scapula.
- C. The PECTORALIS MINOR.
- D. The PECTORALIS MAJOR.
- E. The DELTOIDES seen in part.
- F. The STERNUM.
- G. The MAMMA lying on the Ribs.
- H. The LATISSIMUS DORSI.
- I. The TRICEPS EXTENSOR CUBITI.
- K. The CORACO-BRACHIALIS.
- L. The BICEPS FLEXOR CUBITI.
- M. The BRACHIALIS INTERNUS.
- N. The Inner Condyle of the Humerus.
- O. The PRONATOR TERES.

- P. The SUPINATOR LONGUS.
 Q. The Mass of Flexor Muscles dissected up.
 R. The FLEXOR CARPI ULNARIS.
 S. The Pisiforme Bone.
 T. The Tendons of the Fingers.

ARTERIES.

1. The SUBCLAVIAN ARTERY.*

- The Extent of the AXILLARY ARTERY is from 1 to 9.†
- | | |
|---|--|
| { | 2. Three Thoracic Arteries. |
| { | 3. The long Thoracic Artery
or EXTERNAL MAMMARY Artery. |
| { | 4. SUBSCAPULAR ARTERY. |
5. Branches of the Internal Mammary Artery coming through the interstices of the Cartilages of the Ribs.‡

* To cut for the Subclavian Artery, I recommend the incision to be begun an inch from the inner head of the clavicle; then carry it in a direction slightly deviating from the line parallel with the clavicle, towards the acromion scapulæ. The second incision cuts the fibres of the pectoralis major, where they arise from the clavicle; here we come upon a thick bed of cellular membrane, which being lifted, we find the great subclavian vein, with the cephalic vein joining it; under this vein, and a little further backward (more under the clavicle,) we find the Artery.

† If we have to turn up the edge of the pectoralis major, to tie the axillary artery, we find the artery on the inside of the coraco brachialis; the external cutaneous nerve is on the outside of the artery, the radial nerve on the inside and the muscular spiral below it; the vein is betwixt the artery and the muscle; higher up in the axilla the artery is involved in the plexus.

I need not repeat, that in these descriptions of the exact seat of the arteries I intend that they should enable the surgeon to avoid them, as well as to cut upon them and take them up. By attending to the above circumstances I cut a ragged ball out from behind the artery and nerves without hurting either. *Laceration of this Artery.* GOOCH.—*White's Cases by Gunshot.—Principles of Surgery*, 292.

‡ These arteries are here particularly large and tortuous, implying, that before the woman's death, the gland had been in a state of activity; probably she was a nurse.

6. Branches from the Subscapular Artery to the Mamma.*
7. The POSTERIOR CIRCUMFLEX ARTERY coming in this example from the Subscapular Artery.
8. The ANTERIOR CIRCUMFLEX ARTERY.
9. 9. The BRACHIAL or HUMERAL ARTERY.
10. The SUPERIOR PROFUNDA.
11. The LESSER PROFUNDA.
12. An Artery called R^s. ANASTAMOTICUS MAGNUS.
13. The BRACHIAL ARTERY at its bifurcation.†
14. The ULNAR ARTERY.
15. The RADIAL ARTERY.
16. 16. The RADIAL ARTERY.‡

* Thus we see that in the operation of extirpating the cancerous breast, arteries will throw out their blood from all the sides of the gland, chiefly however from 3 and 6.

† Oblique wound of the humeral artery from without. *Principles of Surgery*, vol. i. p. 431. To find the *Humeral Artery* before coming so low down as this, we may make the patient bend the other arm against a force, in order to throw the expansion of the Biceps Muscle. Having marked its place, we refer it to the wounded arm, and make an incision along the inner edge of the Biceps muscle, or rather, I may say, just where it begins to throw off its tendinous expansion, that is, two fingers breadth from the inner condyle of the os humeri; carry the knife upwards. We do not immediately find the artery, but the Radial Nerve covering the artery; laying the nerve aside, we find the artery lying betwixt its two Venæ Comites.

For the operation of Aneurism here, and the nature of the tumor formed by pricking the artery at the bend of the arm, see *Operative Surgery*, vol. i. Aneurismal Varix, see *Medical Observations and Inquiries*. Wounded in bleeding in the arm, cured by compression by Bourdelot, see *Principles of Surgery*, vol. i. p. 205. Spontaneous cure, *Medical Facts*. Lacerated in violent exertion, from Saviard. *Principles of Surgery*, vol. i. p. 372. Case of wound by fractured humerus, *ibidem*, 340. I have found on dissection that the surgeon had included the Radial nerve in the ligature of the humeral artery. I have found on dissection that the surgeon had put the ligature about the Radial nerve, mistaking it for the humeral artery.

‡ To find the Radial Artery in its course one-third down the arm,—ent on the inner edge of the *supinator longus*, first through the thin fascia—then

17. The branch of the Radial Artery called *Superficialis Volæ*.
18. The RADIAL ARTERY where it is passing under the tendons of the Extensors of the Thumb.
19. The deep Palmar Arch formed principally by the Radial Artery.
20. The A^a. MAGNA POLLICIS, a branch of the Radial Artery.
21. The ULNAR ARTERY lying within the Flexor Carpi Ulnaris.*
22. The PALMAR ARCH formed by the Ulnar Artery.
23. The Branches called digitales from the Superficial Palmar Arch.

lift the edge of the muscle, and under a second fascia you find the Radial artery, passing over the tendon of the *pronator teres*.

1. To take up the Radial artery on the wrist, we cut a quarter of an inch from the radial edge of the *Flexor Carpi Radialis*. A fascia covers the artery here. A small nerve (from the *external cutaneous*) runs above the fascia. *N. B.* The insertion of the *Supinator Radii Longus* is on the outside, but flat, giving no mark outwardly. The *Extensor Primi Internodii Policis* comes obliquely over the head of the Radius, and the insertion of the *Supinator*.

Wound of the Radial Artery. *White's Cases*. Artery stopt by compression. *Scultetus*. A very bad operation by O'Halleran. Correctly performed. *Operative Surgery*, vol. ii. 351. *Principles of Surgery*, vol. i. p. 190. Radial Artery wounded in opening an abscess. *Operative Surgery*, vol. ii. p. 346. Arm amputated for wound of the Radial Artery, from O'Halleran. *Principles of Surgery*, vol. i. p. 191.

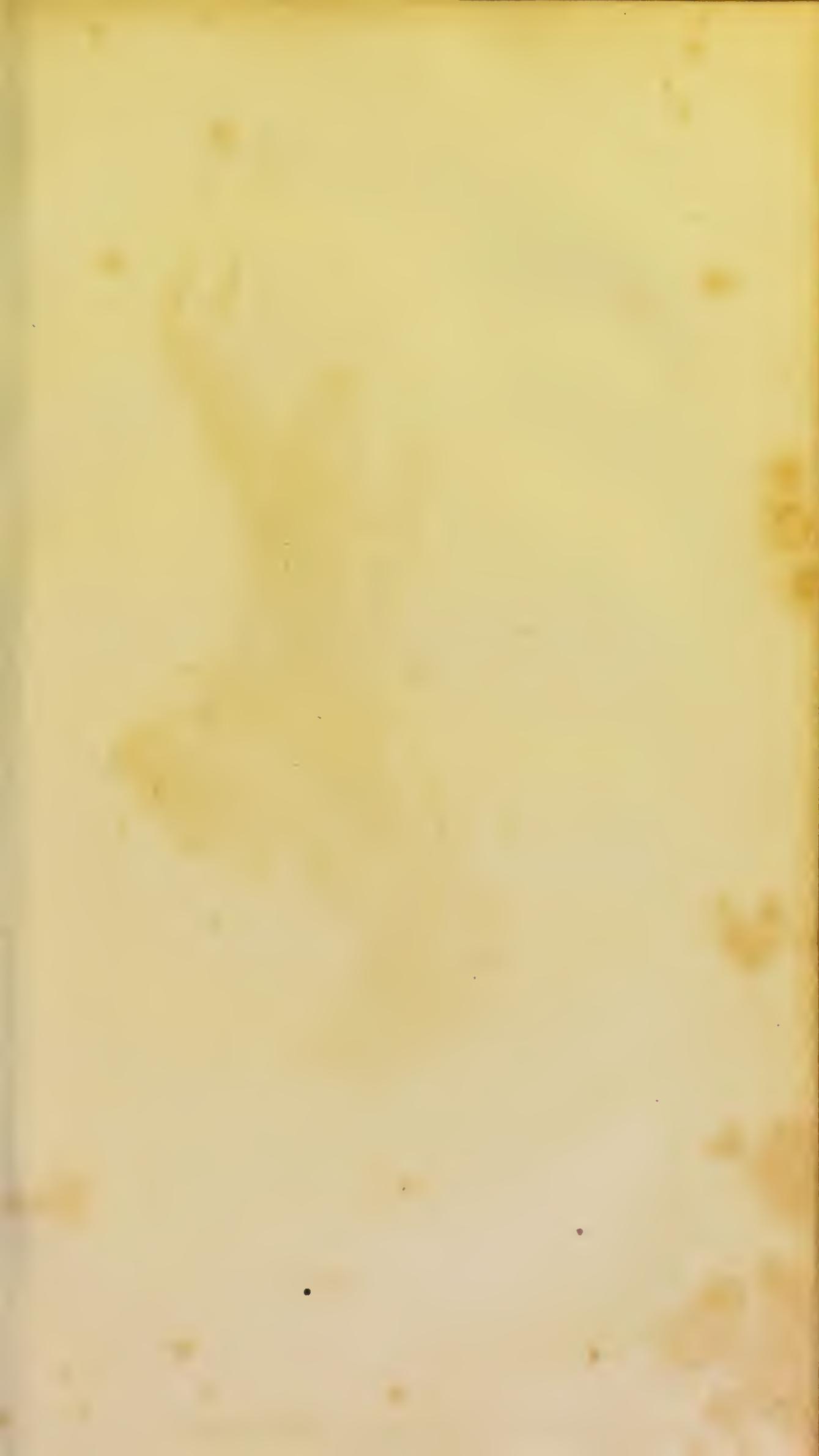
* *Ulnar Artery*. In the middle of the fore arm the artery lies under the fascia, and under the margin of the *Flexor Ulnaris* and *Flexor Digitorum Sublimis*, rather more under the margin of the last. To tie the artery, we should have to cut down betwixt these muscles. The *Ulnar Nerve* lies on the ulnar edge of the artery.

Ulnar Artery tied for wound of the palm. *Principles of Surgery*, 183.

Ulnar Artery wounded by gunshot, stops with slight compression. *Operative Surgery*, vol. ii. p. 341; in a second case, *ibidem*. Case of wound of Radial and Ulnar Arteries by gunshot, *ibidem*, p. 353. *ibidem*, p. 345.

24. The deep Anastamosing branch of the Ulnar Artery which goes under the tendons of the palm to unite with 19, and form the deep Palmar Arch.
25. The ARTERIA INTEROSSEA, a branch of the Ulnar.
(14.)







Cheyne

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THE ARTERIES OF THE HAND.

EXPLANATION

OF

PLATE IX.

- A. The *Flexor Tendons*.
 - B. The EXTENSOR PRIMUS, SECUNDUS, TERTIUS, POL-
LICIS.
 - C. The Tendon of the EXTENSOR CARPI RADIALIS BRE-
VIOR.
 - D. The Tendon of the EXTENSOR CARPI RADIALIS LON-
GIOR.
1. The Radial Artery before turning from the wrist.
 2. The branch to the wrist and palm of the hand, called
SUPERFICIALIS VOLÆ.
 3. The Radial Artery where it lies under the extensor tendons
of the thumb, and where it is in its progress to the
back of the wrist.*

* To cut for the Radial Artery, when it has passed from the fore part of the wrist, we carry the knife on the outside of the insertion of the *Extensor Primi Internodii Policis*, and the inside of the *Extensor Tertii Internodii Policis*. Betwixt these tendons the artery lies very deep, and over it the extreme branch of the *Muscular Spiral Nerve*. We find the artery passing in the notch, betwixt the os scaphoides and the trapezium. This artery tied, see *Operative Surgery*.



Drawn by C. Bell.

Etched by J. Stewart.

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EXPLANATION

OF

*PLATE X.**THE MESENTERIC ARTERIES.*

- A.A. The OMENTUM held up, and bearing the great Arch of the Colon.
- B. The termination of the INTESTINUM ILEON in the Caput Coli.
- C. CAPUT COLI.
- D.E. The ARCH of the COLON, which stretches across the belly.
- F. The SIGMOID FLEXURE of the COLON.
- G. The RECTUM.
- H. The BLADDER of URINE.
1. The AORTA.
 2. The CÆLIAC ARTERY.
 3. The root of the UPPER MESENTERIC ARTERY.
 4. The great Lash of Arteries which go to the small intestines.
 5. The ILEO-COLIC ARTERY.
 6. The RIGHT COLIC ARTERY.
 7. The MIDDLE COLIC ARTERY.
 8. The LOWER MESENTERIC ARTERY.

9. The LEFT COLIC ARTERY; this forming a great inosculation betwixt the Upper and Lower Mesenteric Arteries.
10. The HÆMORRHOIDAL ARTERY descending with the Rectum into the Pelvis.
11. The EMULGENT ARTERY of the left side.
12. The SPERMATIC ARTERY.
13. The MIDDLE SACRAL ARTERY.
14. The COMMON ILIAC ARTERY.
15. The EXTERNAL ILIAC ARTERY.
16. The INTERNAL ILIAC ARTERY.





Enched by C. Bell.

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ARTERIES OF THE THIGH.

EXPLANATION

OF

PLATE XI.

Being a View of the Arteries of the fore part of the Thigh.

-
- A. The Upper and Anterior Spinous process of the OS ILII.
 - B. The PUBES.
 - C. The Tendon of the EXTERNAL OBLIQUE MUSCLE of the Abdomen.
 - D. The ABDOMINAL RING, as it is called.
 - E. The SPERMATIC CORD.
 - F. The SARTORIUS MUSCLE; it is displaced a little, towards the outside.
 - G. The TRICEPS ADDUCTOR FEMORIS.
 - H. The GRACILIS.
 - I. The VASTUS EXTERNUS.
 - K. The RECTUS FEMORIS.
 - L. The VASTUS INTERNUS.

M. The CRURÆUS.

N. The Anterior Crural Nerve. It lies on the outside of the Femoral Artery (not more superficial than the artery.)

O.O. The Integuments hanging loose.

ARTERIES.

1. ARTERIA ILIACA EXTERNA.*

Its branches are, {

2. A^a. Epigastrica, † and from this sometimes the next artery.
3. A^a. Obturatoria.
4. A^a. Circumflexa Illi. ‡

* To see this artery the tendon of the abdominal muscles is slit. It is of consequence to observe the place of this artery: its distance from the points of bone at A and B, and the possibility of cutting through the tendon and thrusting up the Peritoneum, so as to tie it, as in Mr. Abernethy's operation. See *Surgical Observations on Local Diseases and on Aneurisms*, by John Abernethy, p. 230: *Operative Surgery*, vol. i. tit. of *Tying the External Iliac Artery*.

† *Epigastrica*. This artery passes in a direction towards the *Rectus Abdominis*, behind the Spermatic Cord; it is consequently behind the neck of the Sac in *Bubonocoele*. Though rarely, yet sometimes it happens, that the Hernia comes down behind the Spermatic Cord, or nearer to the Pubes, or even so as to split and separate the Vas deferens from the other Spermatic Vessels; in this case the Epigastric Artery lies on the inside of the Sac. I have seen this artery cut in the operation for Hernia. It has been opened in the operation of *Paracentesis Abdominis*, and the patient lost by a hæmorrhage into the belly.

Very often a considerable branch of this artery courses along the edge of the Poupart ligament, towards the Pubes. Its common distribution is thus:

1. To the cord and cremaster muscle.
2. Towards the back of the os pubis.
3. Principal branch ascending upon the rectus.
4. Inosculating with the Internal Mammary.

For the Anatomy see *Tubul. Eustach.* xxv. No. ii. 37. *Inosculation*, tab. xxvii. xii. *Haller Fascic.* v. p. 3. *Note 2. Fascic IV.* No. 12. *Murray, Descrip. Arter. in Tabulas*, p. 89. II. *Anatomy of the Heart and Arteries*, by John Bell.

‡ *Obturator Artery*. We see here what would be the situation of the *Obturator Artery*, if a Hernia should descend under Paupart's ligament in a person having this distribution of the Vessel. See *Mr. Cooper's work on Hernia*.

5. ARTERIA CRURALIS.* Its branches are:

- 6.6. Rami Inguinales.
- 7. Ramus major.†
- 8. Arteriæ pudendæ.‡
- 9. Circumflexa Externa.

This artery, marked 9, coming from the Femoral Artery, belongs, in a general arrangement of the arteries, to the Profunda, but I have represented it as it was in the subject, because it is not unfrequently thus.

10. The proper external Circumflex Artery.

11. The A^a. PROFUNDA FEMORIS.§ Its branches are :

- ^a Irregular branches.
- ^b 12. *Circumflexa Interna*.
- ^c 13. *Great descending internal branch.*||
- ^d *Transverse or External Division*, which in this subject came off from the great femoral (9) and which therefore affords the
- ^e *Descending Exter. Branch.*
- ^f *Circumflexa Externa*, and

* *Arteria Cruralis*, fatal wound. See *History of the Arteries, Anat. of Human Body*, by John and Charles Bell.—Gun-shot wound of this artery. *Principles of Surgery*, vol. i. p. 275.—Lacerated by attempting to lift a heavy weight. *Duncan's Commentaries*.

† Any of these Inguinal Branches being cut near to their origin, may bleed a patient (already perhaps reduced, as by mercury) to death.

‡ The largest of these *External Pudic Arteries*, gives out its blood freely when cut in the operation of Scrotal Hernia, or Extirpation of the Testicle.

§ *Profunda Femoris*. For the history of this piece of anatomy, see *Mr. John Bell's Principles of Surgery*, vol. i. p. 251, & seq. and plates, p. 253, 256. the imperfections of *Eustachius's*, tab. xxv. xxvi. uncorrected by *Albinus*, has been the cause of the neglect of this artery.

|| *Internal branch*. We ought to observe the course of this artery before

- 14, 15, 16. The Perforating Arteries. These are the branches of the division 13, they pass through the triceps, and appear among the hamstring muscles.
17. The Continued Femoral Artery, or ARTERIA SUPERFICIALIS FEMORIS.* Its branches are few, trifling, and irregular, to the parts it passes. The trunk lies betwixt the tendons of the *triceps* G. and the *vastus internus* L. and inclines backward and inward, until it perforates the tendon of the Triceps Muscle.

SUPERFICIAL FEMORAL ARTERY has three branches.

1. *Irregular Branches to the neighbouring parts.*
2. *Rs. Anastomaticus Magnus.* This is the first considerable branch which the Femoral Artery gives off; viz. while

the triceps muscle and its great size. I have known it give way in the ulceration of a gun-shot wound in the thigh. The hemorrhagy was so great that it was conceived it must be from the superficial femoral artery, and amputation was about to be performed, but on undoing the tourniquet, the bleeding did not return. It takes the same general course, but is deeper in the thigh than the femoral artery.

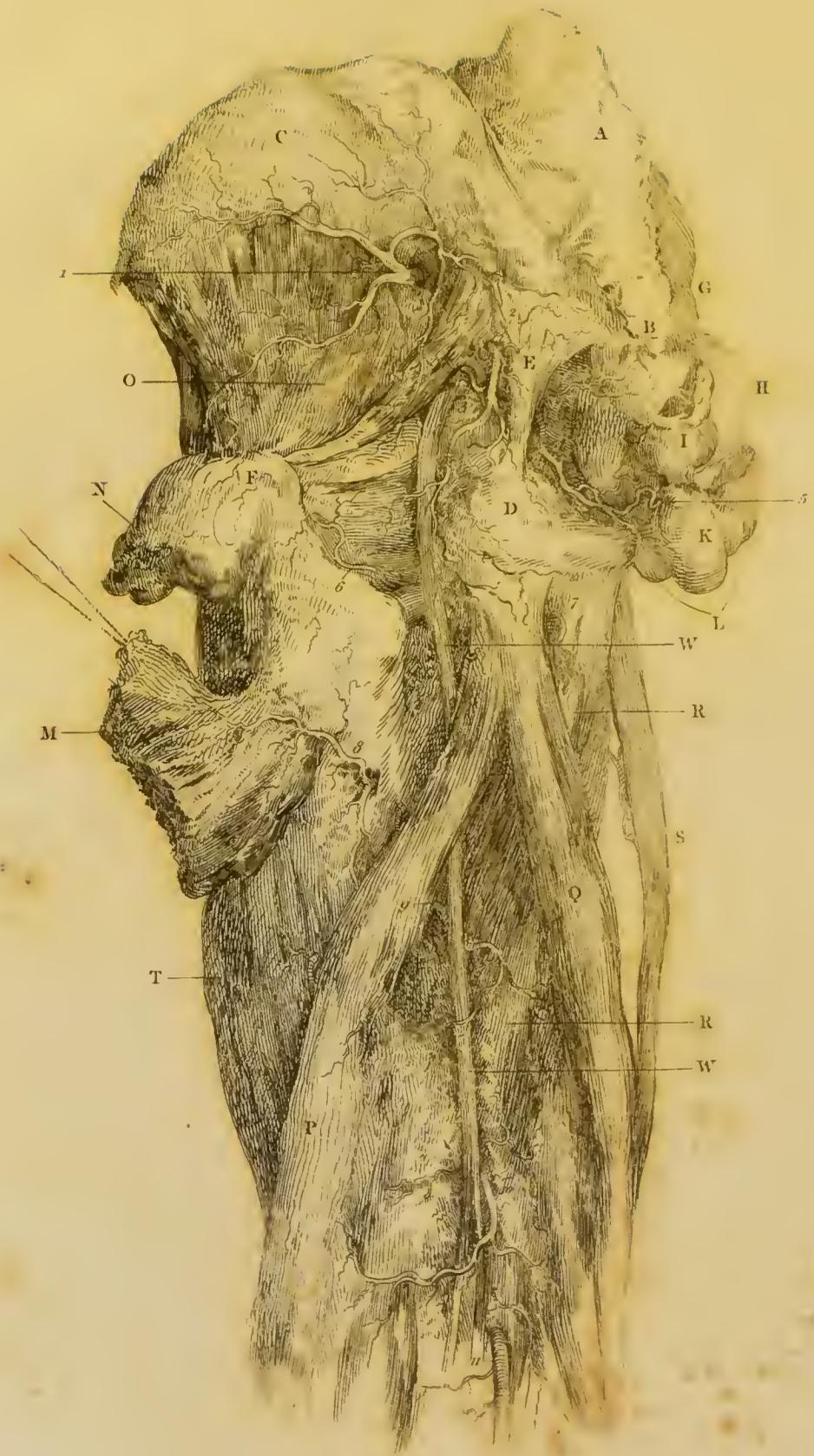
* *Superficialis.* This artery, near the place of its perforating the triceps, is the subject of one of the most important surgical operations, the operation for popliteal aneurism. In dissection it may be well to make this experiment: place a string so as to reach from the superior spine of the os Illii to the prominent part of the inner Condyle, mark the middle of the string, make an incision a very little towards the inside of it, in the direction of the string; first you come to the Sartorius Muscle, next laying that aside, to a fascia, which stretches from the *triceps* to the *vastus internus*; when this is slit up, you may see the artery—observe its situation in regard to the *vein*, the *nervus longus*, and the *sheath* which surrounds it. This artery, where it passes the triceps, wounded by a splinter of the bone. *Principles of Surgery*, vol. i. p. 370, plate p. 373. Lacerated by the action of the muscles, p. 321. Wounded by gun-shot, p. 397, from *Severinus*. Wounded by the point of scissors, p. 390.—Wounded with a knife, and suddenly fatal. *Anatomy of the Human Body*, by John and Charles Bell, vol. i.—Wounded by scissors. *Medical Observations and Inquiries*.

concealed in the tendon of the triceps. After the artery has dipped from the fore part of the thigh, but has not yet emerged behind, or become popliteal, it gives off branches which are improperly called perforantes.

I enumerate these under the term,

3. *Irregular Popliteal Branches*, to the hamstring muscles and their tendons.





ARTERIES OF THE HIP AND HAM.



EXPLANATION

OF

PLATE XII.

*Representing the Dissection of the Hip and back part of the
Thigh.*



- A. The os Sacrum.
- B. The os Coccygis.
- C. The os Ilii.
- D. The os Ischii.
- E. The Sacro-Ischiatic Ligament.
- F. The Trochanter major.
- G. The Rectum.
- H. The Bladder of Urine.
- I. The Prostate Gland.
- K. The Bulb of the Urethra.
- L. The Crura Penis.

MUSCLES.

- M. The GLUTEUS MAXIMUS.
- N. The GLUTEUS MEDIUS.
- O. The GLUTEUS MINIMUS.
- P. The BICEPS FLEXOR CRURIS.
- Q. The SEMI-MEMBRANOSUS.
- R. R. The TRICEPS FEMORIS.
- S. The GRACILIS.
- T. The VASTUS EXTERNUS.
- W. The SACRO-ISCHIATIC NERVE.

ARTERIES.

1. ARTERIA GLUTEA.* It is seen here coming out from under the Sacro-ischiatic notch, and immediately dividing into these branches:

- a. Muscular branches within the pelvis and at its exit.
- b. R^s. Superficialis: viz. under the gluteus maximus.
- c. R^s. Ascendens: viz. under the gluteus medius.
- d. R^s. Transversus: viz. under the gluteus medius, and forward.

* *Gluteal Artery.* An Aneurism from a wound of this artery, in consequence of a man sitting down with large shears in his pocket, which ran into his hip. *Discourses on Wounds, by Mr. John Bell.*—A Case by Professor Jeffery, where the patient died by the bursting of the tumour. See *Principles of Surgery*, vol. i. p. 424.

2. ARTERIA ISCHIATICA.*

Within the pelvis, and in its passage out, this artery branches to the bladder, rectum, and neighbouring muscles: on the back of the pelvis, to the glutei, to the great nerve, to the lesser muscles of the thigh bone, in many profuse branches.

3. ARTERIA PUDICA COMMUNIS,† where it is seen on the back of the Pelvis. It enters again under the Ischiatic ligament.

In case of a wound of this artery, and the consequent formation of a false Aneurism, the Surgeon, after puncturing the tumour, has to push his finger deep amongst the blood until he arrive at the trunk, as it turns over the notch of the Ilium—Compressing it there, he may gain time.—For this reason I wish to point my readers' attention to the place where the trunk turns over the bone.

* *The Ischiatic Artery* being equally liable to accident with the Gluteal Artery, it may be well to look to the subject after the following description of its place.

To hit upon the ischiatic artery as it comes out from the pelvis, begin the incision by the side of the sacrum, three fingers' breadth from the posterior spinous process of the ilium; and carry it down in the length of the fibres of the gluteus maximus, to the outside of the tuberosity of the ischium. Even in a thin man, the artery lies two inches deep. Now, pushing in the finger as if under the sacrum, we there feel the acute edge of the sacro-sciatic ligament; on the lower margin of the sacro-sciatic hole, (which is distinctly felt with the finger amongst the looser parts,) the artery is felt crossing the ligament obliquely; near it, upon its outer side, are some lesser nerves; the great sciatic nerve is removed an inch from it.

† *The Pudic Artery*. The branch which is seen in the Plate to cross the Perineum, is necessarily cut in the operation of *lithotomy*. Often I may venture

to

4. The PUDICA COMMUNIS, where it is on the inside of the os Ischii. Here the artery divides into these branches :

- a. Hemorrhoida Externa.
- b. Perinea Superficialis.
- c. Transversalis Perenei.
- d. Profunda Penis.

from which last comes off

- e. The Superficialis Penis.
- f. The Artery of the Bulb.
- g. The deep Artery of the
Cavernous Substance.

- 5. Is the artery entering the Bulb of the Spongy body of the Urethra.*
- 6. A Branch of the ARTERIA CIRCUMFLEXA INTERNA, inosculating with the Gluteal Artery.
- 7. A branch of the OBTURATORIA. It inosculates with the Ischiatic Artery.
- 8. A large perforating Artery, a branch of the Profunda.
- 9. Another large perforating Artery—from the Profunda.
- 10. A Third Perforating Artery.

to say the principal artery, where it lies close on the bone, is cut in this operation. See *Operative Surgery*, vol. i. where *the Artery of the Bulb* enters (at 5), I am pretty certain that it has been opened by the caustic, in a case of Stricture, since I have been consulted by a patient, after repeated Hemorrhage, for three weeks after the caustic had been applied. See my *Letters on the Diseases of the Urethra*.

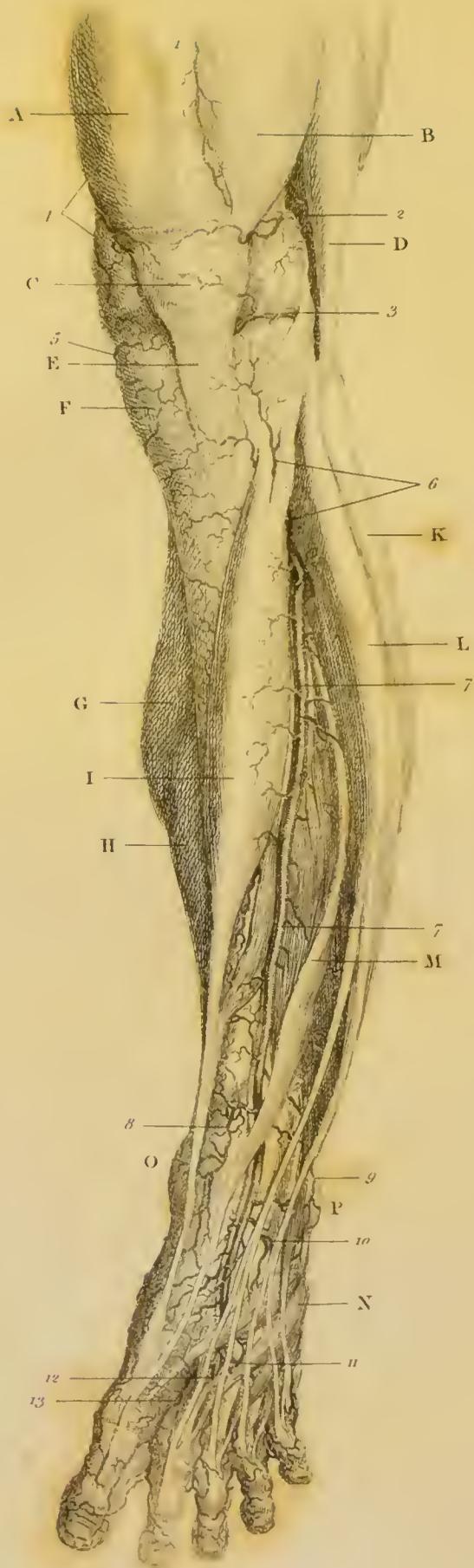
* Betwixt the Branches of Arteries, 2, 6, 7, 8, 9, there are free inosculation which preserve the limb alive, though the main artery be tied on the fore part of the Thigh or in the Groin : see some observations on the Course of Circulation when the main artery is tied. *Operative Surgery*, vol. ii.

11. ARTERIA POPLITEA* or main artery of the limb
after coming through the tendon of the Triceps
muscle.

* *Arteria Poplitea*, Wounded by a Sabre : *Principles of Surgery*, p. 323.
Wounded by the sharp projection of the femur after fracture : *Operative
Surgery*, vol. ii. 357.







EXPLANATION

OF

PLATE XIII.

 ARTERIES OF THE LEG.

MUSCLES, &c.

- A. THE VASTUS INTERNUS.
- B. THE VASTUS EXTERNUS. Betwixt these two muscles is the tendon of the RECTUS FEMORIS.
- C. THE PATELLA or knee-pan, on each side of which are seen the CONDYLES of the FEMUR.
- D. THE BICEPS FLEXOR CRURIS.
- E. THE LIGAMENT of the PATELLA.
- F. THE HEAD OF THE TIBIA.
- G. THE GASTROCNEMIUS.
- H. THE SOLLEUS.
- I. THE TIBIALIS ANTICUS.
- K. THE PERONEUS LONGUS.
- L. THE EXTENSOR DIGITORUM COMMUNIS.
- M. THE EXTENSOR POLLICIS.
- N. THE EXTENSOR BREVIS DIGITORUM PEDIS.
- O. THE MALLEOLUS INTERNUS or lower head of the Tibia.
- P. THE MALLEOLUS EXTERNUS, being the extremity of the Fibula.

ARTERIES.

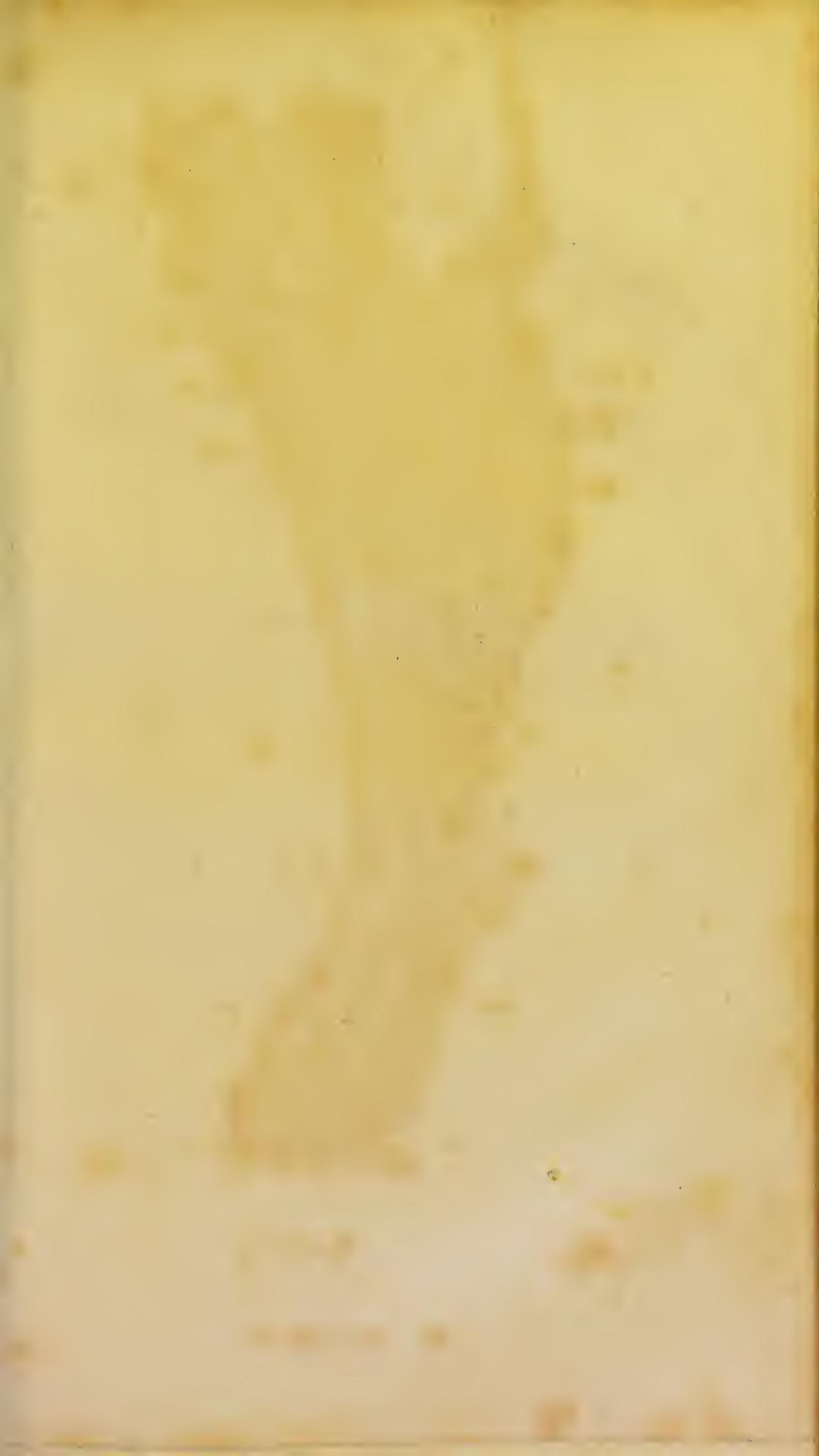
(Arteries encircling the knee joint:)

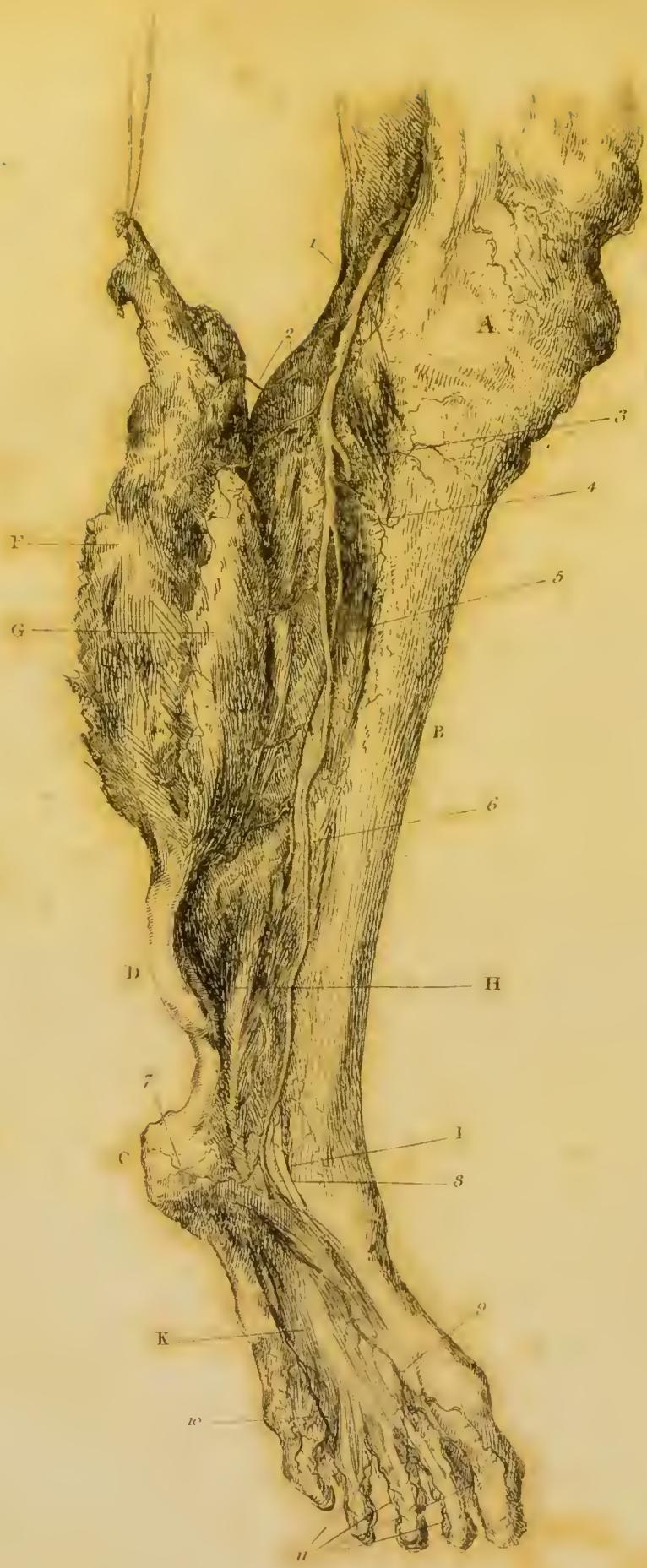
1. *Arteria Superior Patella.* (Haller).
2. *Articularis Superior Externa.*
3. *Articularis Inferior Externa.*
4. *Articularis Superior Interna.*
5. *Articularis Inferior Interna.*
6. *Recurrans Tibialis.*
7. 7. ARTERIA TIBIALIS ANTERIOR, many branches are seen going off from this artery to the Tibialis Anticus muscle and the Extensors of the toes.*
 8. *Malleolaris Interna.*
 9. *Malleolaris Externa.*
 10. *Tarsea.*
 11. *Metatarsa.*
 12. *Ramus Arteriæ tibialis Anastamoticus.* This is the great anastomosing branch of the *tibialis* descending to unite with the tarsal arteries in the sole of the foot. It passes betwixt the metatarsal bones of the great toe, and that which is next to it.
 13. *Ramus Dorsalis Pollicis or Halucis.*

* *Arteria tibialis Anterior.* This artery lies so under the projection of the Tibia, that it is not often wounded; yet it may be cut by a deep wound, and the student ought to observe how it lies under the Fascia and muscles.

“The Anterior Tibial Artery comes through betwixt the bones, one inch below the projection of the knob of the Fibula. To find it, we cut through the strong fascia which is extended betwixt the Tibia and Fibula; we then cut by the edge of the *Peroneus longus*, and follow the partition fascia which is betwixt this muscle and the head of the *Extensor Digitorum Communis*. This partition carries us deep, and we find the artery lying on the interosseous ligament.”

When the artery is to be tied lower down, after slitting up the fascia, we must cut betwixt the *Tibialis Anticus* I. and *Extensor Pollicis* M.





EXPLANATION

OF

PLATE XIV.

*This Plate exhibits the Arteries on the back part of the Leg
and Sole of the Foot.*

- A. The inside of the knee.
- B. The TIBIA.
- C. The heel, or *os calcis*.
- D. The TENDO ACHILLIS, being the tendon of the following muscles, viz.
- E.F. The GASTROCNEMIUS MUSCLE.
- G. THE SOLEUS MUSCLE.

ARTERIES.

1. The Popliteal Artery.*
-

* *Popliteal Artery.* Wounded on the fractured end of the femur: *Operative Surgery.* Wounded by a splinter of the tibia: *Principles of Surgery,* under the head of *Aneurism.*

2. The branches of the Popliteal Artery, called *Surales*. They go to the heads of the Gastrocnemius Muscle.

N. B. The Articular Arteries are concealed here. They are five in number; two *Superior Articular Arteries*, which encircle the joint, two *Inferior Articular Arteries*, which encircle the lower part of the joint, and one which is irregularly distributed to the back of the knee joint.

3. *Anterior tibial Artery*.
 4. The division of the artery into the posterior tibial and fibular arteries.
 5. The *Fibular Artery*.*
 6. The *posterior Tibial Artery*.†

* To cut for the *Fibular Artery*.

“ To find this artery, two hands' breadth from the heel, cut betwixt the Gastrocnemius and the Peroneus Longus, *i. e.* on the out-side of the Gastrocnemius where it is becoming tendinous; turn up the edge of the tendon; you then find the Flexor Pollicis covered with its sheath.

“ If you seek for the Fibular Artery by going deep in the leg without piercing this Fascia, or sheath, you find the Tibial Nerve, and may come on the Tibial Artery. To find the Fibular, then, we cut down by the side of the bone (Fibula) and raise the fibrous origins of the Flexor Pollicis. We then find the artery by the acute edge of the bone lying on the Interosseous Ligaments, accompanied only by its venæ comites.”

† *Posterior Tibial Artery*. To take up the Posterior Tibial Artery:

“ For complicated wounds in the sole of the foot, this artery may require to be taken up behind the Ankle-Joint, and before it pierces under the Abductor Pollicis Pedis. We shall be directed to the exact place by observing the lowest projecting part of the Tibia. The tendons which run close upon this tuberosity of the bone, are the Tibialis Posticus, and Flexor Communis; the first lies so closely braced to the bone in its particular sheath, that it will not be observed; the artery runs a little nearer the heel than the tendon of the Flexor Communis, a Fascia braces down the artery, and the nerve is under the Artery.”

Operative Surgery, vol. ii. page 337—8.

7. *Calcanea*, a branch of the posterior tibial artery to the heel.
8. The division of the *Posterior Tibial Artery*, into the Plantar Arteries.
9. The *Internal Plantar Artery*.
10. The *External Plantar Artery*.
11. The division of the last to the toes.

FINIS.

J. M^CREERY, Printer,
Black-Horse-court, Fleet-street, London.





A

DISSERTATION

ON

GUN-SHOT WOUNDS.

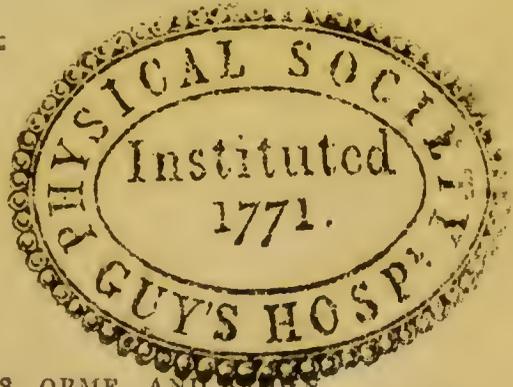
By CHARLES BELL,

SURGEON OF THE MIDDLESEX HOSPITAL;
FELLOW OF THE ROYAL SOCIETY, AND OF THE ROYAL
COLLEGE OF SURGEONS OF EDINBURGH;
MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF LONDON;
ASSOCIATE OF OTHER LEARNED BODIES;
AND READER OF ANATOMY IN THE CHAIR OF DR. HUNTER.

LONDON.

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Printers-Street, London:

A DISSERTATION, &c.



IT is too common an opinion with surgeons in domestic practice, and in hospitals here at home, that there is nothing peculiar in gun-shot wounds. I have often heard it said that a gun-shot wound is but a bruised wound, and that when the slough is discharged it is but a common wound. It is mortifying to the pride of theory to see how often it is humbled before the conviction of practice: even the scenes I have witnessed, and the cases I have

The above sketch represents the fungus cerebri from gun-shot fractures.

had under my care, have proved to me that the books we possess upon the subject of field-practice do not even hint at the nature of the difficulties the surgeon has to encounter there. In the nature and in the progress of gun-shot wounds, there is much to be observed which never is to be seen in domestic practice. Not only is the surgeon placed in a very peculiar and trying situation, where his knowledge must be ready, and his judgment clear, and his practice decisive, but his opinion on the cases of those wounded in battle is to be formed from circumstances widely different from those which guide the domestic surgeon in his practice.

As my object in the few observations I have to make is not to fall into the old question of the peculiarity of the wound by fire-arms, but rather to place before my reader the difficulties of the service, I shall first enumerate the principal varieties of wounds brought into the cockpit of a man-of-war during a sea-fight, with something of the detail of the preparations.

The surgeon of a ship, before he quits the port, ought to provide himself with a small chest of bandages and dressings; callico-rollers, tow, lint, linen, and plaster, also sponges and compresses, and prepared ligatures. There ought also to be deposited in this chest a number of common tourniquets besides those kept in the other cases of instruments. This chest should be kept reserved for the day of action, and it ought to be in such order that when opened during an engagement, all that it contains should at once be under the eye; so that any thing
may

may be taken out without disordering the arrangement.

When the physician of a fleet goes aboard to examine the state of his department, his first care is to look to the surgeon's instruments; because they are at once so essential in practice, and they inform him of the surgeon's habits of order and attention. The occasion for their use comes so suddenly; the cases are of such high magnitude; and the difficulties accumulate so fast during an engagement, that unless all be prepared beforehand, no degree of activity, though united with the greatest imaginable presence of mind, can enable the surgeon to fulfil his duty.

When the drum beats to quarters, the surgeon has to see that the operation table is securely fixed; that there is sufficient supply of candles and lanterns, and that the assistants know their places. He has to consider also what provision is made for the wounded after they are dressed, and to see that the cots are hung up in the tiers or other safe places. It is now a time of fearful expectation, and there are few situations in which a man more requires coolness of reflection. It is now that he feels how much the nature of the wounds of those who may be brought down to him ought to have occupied his mind in previous study.

Almost every kind of wound to which men are exposed in the field of battle, comes also under the care of the navy-surgeon, together with a greater proportion of wounds contused and lacerated, from splinters and bolts torn from the sides of the ship,

and the carriages of the cannon: besides, there the surgeon must expect men to be brought down to him extensively burned by the explosion of gun-powder, and for these he ought to have proper dressings provided.

When great shot enter through the sides of a ship the mischief they do is in proportion to their diminished velocity. For when their course is with great velocity, they pass clear through and destroy only what they touch; but when they enter with a lessened force, they tear up the ship's side throwing the splinters around, and causing splinter wounds.

During the American war, and in former times when the hostile fleets of great Britain and France engaged at a distance, splinter wounds were more frequent than in our late engagements. In the war which has just terminated, and in the former, it has been the rule to approach within musket-shot of the enemy. A severe loss falls in consequence on the men in the poop, quarter deck, and fore-castle by musket and cannister shot, and grape shot. Indeed more men are killed and wounded in proportion to their numbers in these exposed situations, than in the other parts of the ship. Even in the lower deck during a close action, more injury is done by shot than by splinters*. It sometimes happens, though much more rarely in our ships than in foreign service, that a gun bursts. Then there is

* In the action of Trafalgar, the Revenge lost twenty-five men killed, and fifty wounded: of those eight men only were killed in the lower deck, and these by one shot.

a complication of wounds : limbs are half torn off ; the flesh lacerated ; perhaps the cavities opened irregular pieces of iron are driven deep and many are scorched. In expeditions with boats, if a surgeon or mate be sent, he can only be required to stop the blood from recent wounds, to use the compress and roller, or the tourniquet. In boarding, the wounds must be of the most dangerous kind, being with the pike and cutlass, fractured skulls, deep flesh wounds where the great vessels are cut, and stabs penetrating the great cavities.

Let us now turn our attention to *the circumstances in which the army-surgeon finds himself*. If the navy-surgeon has difficulties to encounter, from having many thrown upon him at once hurriedly, the army-surgeon requires to have even still more resources in himself. When his patients are thrown in crowds into churches and convents, or lie in the streets of a town, as after a great engagement, or are hurried off in the bustle and confusion of a retreat, he has no opportunity of applying the resources of his art ; but ought not this to have been foreseen ? shall it be again said, that this is no time for thinking of individual cases or of operations ? It is the very precise time in which the prompt determination of the surgeon is of the first consequence, and now also ought the amputations to be performed on the patients whose circumstances require it. It becomes a duty of the first importance to secure, on a large scale, the supply of those things which are necessary to the immediate safety. It is the surgeon's duty to see that there be provided, and properly

properly supplied, compresses, and rollers, and lint, and linen cloth, to be kept wet on the wounded limbs. But it is above all necessary, that he shall previously have consulted with those who foresee, or controul the operation of the field, so that he may have prepared a place of temporary retreat, where he may be provided with proper assistants, instruments, and dressings, for the performance of operations. The French surgeons accuse us of deferring our field operations too long, and even of negligence in our naval department where there can be no temptation to defer amputations. But we can both repel this accusation and convey a censure at the same time, by affirming that they are ignorant of what we are doing in England. But, no doubt, better times are coming, when the members of the profession in the two countries will become a mutual assistance to each other; the intercourse has auspiciously commenced.

Often I have been told, when enquiring for facts, "Cases, Sir, (the surgeon has said) how can you expect them, when we are stepping over bodies to see who are beyond help and who are yet alive?" Thus it is that the greatest opportunities are lost, and the extent of the field of observation is the apology for ignorance. Individual cases in detail are not indeed to be expected in such awful circumstances; but there are occasions from which the most important lessons may be drawn, and observations made on a great scale, of the most signal use to science and the service — where the incidents of an age of ordinary practice are brought
at

at once under the eye. Especially in the subsequent hospital management of these cases, the most inestimable opportunities are afforded for the improvement of the profession. Cases of the same kind are brought together, occurring in circumstances nearly alike, and exhibiting the great features and peculiar character of wounds, while lesser particulars, that in a single case are apt to be mistaken for necessary adjuncts, come on the general view of these cases to appear in their true characters of incidental circumstances which no longer can distract the judgment.

In order to secure to the surgeon that information which may be drawn from an extensive field of observation, and to facilitate his observations, it is necessary that the wounded be classed according to the nature and severity of their wounds. This will make the business of the day easy to the inferior officers, and enable the inspectors at once to see what cases are desperate, what require consultation, and how many need merely to be kept in free air, and on low diet, with wet linen on their wounds. Every thing that facilitates business in such a scene is of consequence to the wounded; because time and consideration can then be given to such as require it; and whatever brings forward into notice the cases of difficulty, is of the first consequence both to the service and to the improvement of the profession.

When the surgeon comes to determine on the cases under his care, it is distracting to pass from a man with a wound in the belly to one with a
shattered

shattered bone; from a case of wounded lung to the question of amputation; here a gun-shot fracture of the skull, and the next a ball lodged in the knee joint. If, instead of this, the cases are properly arranged, the prevailing symptoms of danger press forward strongly on the attention, and one case illustrates and clears the obscurities in another. Where there are many cases of fracture of the skull, or of bullets through the head the prevailing symptoms of danger make the most forcible impression on the surgeon's mind, where these cases are classed together. First a man begins to be oppressed, and to have twitching of the muscles of the face; he then falls into terrible convulsions and muttering delirium. In the mean time another is attacked with similar symptoms, and both are seen struggling in convulsions; a third is attacked, and the first finds relief in the insensibility which precedes death. — Thus the occurrence of threatening symptoms in one patient becomes a forewarning for the benefit of others, urging the necessity of a certain line of practice. The suffering or the death of one is thus the safety of the rest, as when the leading ship takes the ground, and becomes a beacon to steer the others by. When several men have been struck with musket-balls which have lodged in the great bones, the wounds being received in the same day, and there being a general resemblance in them, the violence of inflammation comes at the same time and with a prevailing character, and there is great swelling of the limb, and abscesses in parts of the
limb

limb remote from where the ball is lodged. The effect of the injury to a bone, and a lodgement of the ball, is evident to observation. Whereas, witnessing a single or isolated case, the surgeon might mistake the abscess forming in the calf of the leg from a wound of the femur, as proceeding from an accidental injury there.—I must add that the army-surgeon seeking to improve himself requires not to interfere with any general arrangement; he can make the classification in his own note book, and in it see the general results.

OF A WOUND BY A MUSKET-BALL.

WHEN a man is mortally wounded he leaps from the ranks, or from the saddle, before he falls.— Often a man is wounded without knowing it, until his fellow sees the blood trickling from him, but this is in the heat of fight.— There is in severe wounds an alarm, oppression, and faintness, and the contents of the stomach are discharged; and often a confusion of mind, coldness, and insensibility attends them, or there come rigors, nausea, and want of sensation in the extremities. If insensibility continues during the necessary operations, it is an unfavourable sign. This is because the injury has borne on the constitutional powers; and so a burning drought, restlessness, and inquietude, after great wounds of every description, are symptoms of danger.

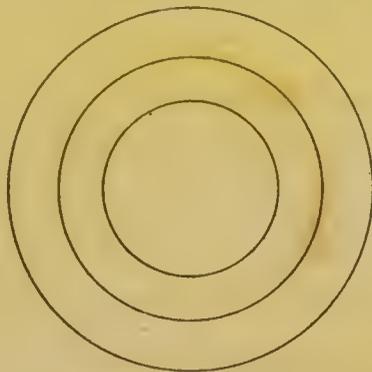
1. The transit of a bullet through a limb is made with a rapidity so foreign to the usual course of sensation, that no pain or even very
distinct

distinct idea is conveyed. 2. The blood does not flow so freely in gun-shot wounds as it does in other wounds, because the vessels and nerves are benumbed and paralysed by the pressure of the ball in its passage, and the small vessels which would bleed, were they open, are closed by the bruised parts; for what part is touched by the bullet is not carried away, but left for a time attached to the living parts. 3. The appearance of a gun-shot wound is much like that of a wound made in the dead body, only that there is around the gun-shot wound a slight blackness of the skin, and the blackened cellular substance is seen within the wound. 4. In surgery we may observe that inflammation and pain go together; and, as in gun-shot wound, there has been little pain, so for some time there will be no inflammation. 5. But the inflammation of gun-shot wound is by and bye deep and extensive; it is not so much an inflammation of the wound as of the whole limb. There is a passage made through the substance, and the sides of this passage are deadened: a living part become dead is as a foreign body in the wound, and therefore the shot hole must inflame in its whole extent, because the living substance is irritated by the contact of the dead matter. The inflammation is in a great measure the act of the living surface ulcerating and separating from the dead slough. The dead matter comes out like a piece of dirty rag, or chewed paper. We speak of the slough discharging itself, and of the separation of the slough, but the dead matter is passive; its discharge is owing to

to

to the ulceration, and the weeping secretion of the living part.

Let us take this in another light ; — a bullet being an obtuse body forced through the flesh, and yet taking none of the substance away, the parts are in its rapid passage pushed aside, but so bruised that their life is destroyed. Thus the suppuration of the wound, and the separation of the dead matter, must be counted as a first step to recovery ; 6. But the inflammation of a gun-shot wound is not caused merely by the circumstance of dead matter being in the tract of the wound, the ball has also injured the parts which remain alive, and the surrounding living tube has received the shock and pressure of the parts deadened by the immediate contact of the ball in its passage.



I shall suppose that the innermost of these circles corresponds to the diameter of the ball, the substance occupying this inmost circle is forced aside, and is condensed into the space betwixt the internal and second circle, and consequently it is mashed and destroyed. It is at the same time evident, that the substance occupying the space betwixt the second and third circle must, by the recoil

recoil of the deadened substance, be displaced with a force of percussion proportioned to the velocity of the ball. This portion of the substance being benumbed, or rendered paralytic, requires some time to recover its vital powers, but when it does react and inflame, the inflammation is in degree corresponding with the violence of the injury which has been sustained. These considerations will explain the following circumstances.

As it is the velocity of the ball which produces the peculiar character of gun-shot wound, and as the force of the ball must be somewhat spent in its passage, from the resistance it meets with, the part at which the ball makes its exit will be less distinguishable from the nature of a common wound than that at which it entered. Accordingly the orifice at which the ball passes out assumes the inflammatory action more quickly and heals sooner than that at which it entered; indeed instances occur where the counter wound heals by the first intention. By reference to the same principles we see how it happens that when a ball strikes obliquely on a bone, and is flattened, it glides outward, and being now sharp it cuts the skin. The obtuseness of the ball being a principal cause of the peculiarity in the wound it makes, when it has lost its form, the wound it makes loses also, in considerable degree, the character peculiar to bullet wounds.— In examining gun-shot wounds even twelve or fifteen days after they have been received, I have been able to distinguish in what direction the ball went. In the early days the wound at which the ball

ball entered is the smaller, afterwards it becomes much the larger. Where the ball entered there is a small black hole; where it made its exit the opening is more torn and larger;—this is at first: the reverse exactly is the case afterwards, for the entrance of the ball is a large wound, at which the skin is wasted, and where much slough hangs out; while the orifice in the opposite side of the limb is in a state of healing, or at least contracting. In plate I. I have sketched two wounds on one body, I saw the two patients at the same time, and thought I might take the liberty of transferring the wound of one of them to the other in representation. The ball entered under the integuments of the belly, and it being ten or twelve days after the wound was received, I knew A to be the entrance of the ball, and B to be its exit, because the hole A being choaked with slough, implied that there the ball had more velocity, and produced a more violent attrition. — The lower wound was through both testicles, and C was the entrance of the ball, as I knew from the same circumstances, viz. the greater inflammation, and the greater mass of slough which hung from the wound. *

In the case of John Roe, which is given under the head of wounded arteries, there was, I trust, a rare example, proving the nature of gun-shot wounds, in respect to the death of the surface exposed, and shewing that it cannot be brought to

* There was some talk of amputating the testicles: but wherefore? I have learnt, that this man has since had a child.

unite. A grape-shot, after passing through the fore arm, entered under the integuments of the belly, and ran betwixt them and the muscles. The wound was directly over the scrobiculus cordis, and from the looseness of the part, and the ball being in some degree spent, the wound was large and ragged, so that the surgeon's hand being held conically, could be thrust into the orifice at which the ball entered, and the finger could be brought out at the counter opening. The surgeon sewed this wound with three great stiches of the needle. But there was very little pain in the operation, a sure sign that it would not succeed. The edges of the wound being dead, it was necessary they should slough. Eight days after the battle, it was found necessary to cut the stiches, which gave great and immediate relief.

OF THE COURSE OF A BULLET, AND OF THE PROBABLE PLACE
OF LODGEMENT.

IN a short time after the infliction of the wound, if the ball has taken a course under the skin, we may perceive the course it has taken by a red stripe on the skin, like a blush of the cutaneous vessels. By attending to this circumstance, I have discovered the ball in a remote and unexpected place. The passage which a ball makes is very seldom direct; a very slight degree of lateral resistance changes its course. The most frequent place of its lodgement is just under the integuments of the opposite side of the limb to where it entered.

entered. For we find that a ball pierces the resisting solids more easily than it does the elastic skin. For example, a ball after breaking the bone, and passing clear through the muscular substance, being met by the elastic resistance of the skin, has its force subdued, and it remains under the skin, where a touch with a lancet will give it exit.

If a ball strikes perpendicular to the surface of a spongy bone, it will enter and lodge in the bone, as in the vertebræ, or in the head of the thigh-bone. In fig. 1. plate II., the ball A is seen sunk into the condyle of the femur; but this situation of the ball is not so frequent as that exhibited in the second figure, where A is the hole where the ball entered, and B is the ball itself, lodged not in the bone properly, but on the posterior surface, where, although it had force to penetrate the bone, had not force to overcome the resistance of the elastic ligament. This is not a solitary instance: in the fourth figure of the succeeding plate, the ball has passed through the body of the vertebræ, but has not been able to burst up the posterior longitudinal ligament. I have in my collection, a ball lodged in the hip joint, where the ball has broken and penetrated the neck of the thigh-bone, but has not had force to pass out of the capsular ligament. A young gentleman consulted me within these few days, with a ball in his foot; the ball had penetrated the tarsus, but was prevented making its exit by the plantar aponeurosis. The Baron Driesen, who is here under my care, has received a ball which has penetrated

the inner condyle of the thigh, but lies arrested at the root of the crucial ligaments, where they take attachment to the notch of the thigh-bone B. An officer came to me who had received a ball in the back of the elbow joint; it penetrated the olecranon and humerus, and lay under the tendon of the brachialis internus. My reader will perceive that this lodgement of the ball, which has penetrated a bone, is accounted for on the same principle with that of the ball which has traversed the limb, and lodges just under the skin of the opposite side: elasticity, possessed by the skin in the one instance, and the ligaments in the other, is a power more capable of subduing the force of the ball than the more solid resistance of either the muscle or the bone.*

If a ball strikes a hard bone with a force not sufficient to break it, the ball will be flattened, and, slanting off, will cut into the soft parts in a new direction. A ball hitting a bone is more apt to splinter it when its velocity is diminished. The

* It is the same principle which explains the circumstance so frequently occurring of the ball being found within the trowsers, and that again explains how it happens, that a ball penetrates the urinary bladder, from whence it is unable to escape through the yielding coats. I saw some years ago a very singular exhibition, which is to be accounted for in the same way; a soldier received a musket-ball in the globe of the eye, where it remained: it was in that situation too valuable for him to consent to have it extracted. A gentleman received a bullet in the side, it coursed round the belly betwixt the abdominal muscles until it was stopt in the sheath of the rectus, and there I have let it remain, as it gives no pain, and is not likely to be attended with future danger.

difference

difference of effect proceeding from the greater or lesser velocity, is well exemplified by a drawing of my brother's, I have before me. The anterior plate of the frontal sinus was pierced by a pistol ball, but the ball could not pass through the second plate of bone, but was flattened against it. In this case, it was necessary to apply the trephine before the lead could be extracted. I could give many instances to prove that when a leaden ball has struck a bone, we have not in our search to expect to feel a ball, but an irregular piece of lead. Sometimes the ball is cut in two, but oftener it is so flattened as to resemble half a ball. When a ball is turned off from the surface of a bone, it generally takes an oblique course among the cellular substances, and runs a long way under the skin. I have been informed, that a pistol bullet entered the right fore-arm of a duellist, and was stopt by the radius of the left arm, the arm being bent:—that a man being shot in the outside of the right thigh, the ball made its exit on the corresponding part of the left. This latter instance I can the more readily believe, having seen a wound in the middle of the left thigh, and the ball cut out upon the outside of the right hip: if it had met the trochanter it would have been directed down the right thigh. In the accompanying sketches there is the representation of two soldiers, who were wounded at Corunna, where the balls entered at the same part of the back in both, viz. betwixt the spine and the bone of the scapula. In the one case the ball

went through the chest, and made its exit above the right breast; the other came over the shoulder, and lay under the skin of the fore part of the breast, where it was cut out. As they lay in the ward together, I was struck with the contrast they offered.

In the specimens of balls lodging in bones, or which have passed through them, which from time to time I have picked up, none of them are changed in figure. It does not absolutely follow, that a ball which has entered a bone shall retain its spherical form, yet it does so for the most part; but if it has struck a bone, and glided off among the soft parts, it will be found flat or irregular.

If, however, a ball strikes and splinters a bone, and then lodges in the soft parts, there is a probability that the lead will be quite irregular and ragged. For example, if a ball has passed through the wrist, or fractured the radius, and has passed out and entered again into the side, or arm, or axilla, we shall probably find a piece of lead no longer retaining the figure of a ball. In such circumstances I have found a piece of lead as irregular as if it had been melted and cast into water.

In searching for a ball, it may be thought very easy to distinguish with the probe betwixt the surface of the lead and the bone, but it is not always so, and I have been deceived, and have seen experienced military surgeons tugging on what proved to be a portion of the bone. When it is important to discover, whether what we feel be

the ball, or a portion of bone, we must bore the finger into the wound. A circumstance particularly apt to deceive us in an old wound, is a concretion which forms on the ball, and which gives it more the sensation of a bone.

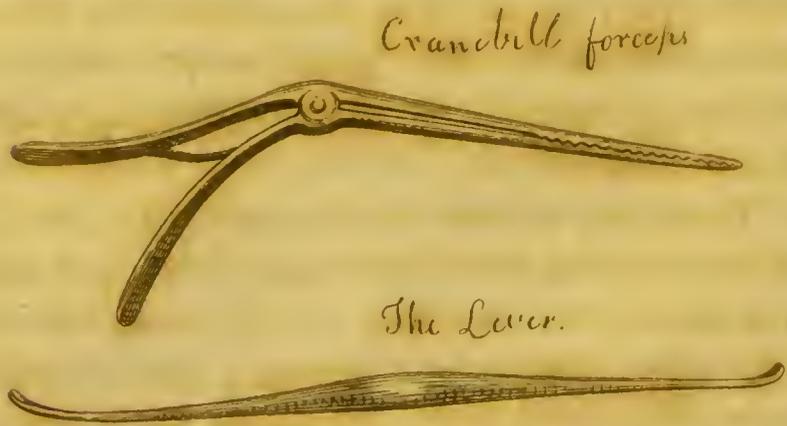
A ball may sometimes be felt through the skin as if it lay quite superficially, and yet it shall be deep. I have heard a surgeon, while he was cutting for a ball, declare, that he believed the deeper he cut, the more substance was betwixt him and the ball. — An abscess will sometimes show the place of the ball, as in plate VI., where an abscess on the breast declared the place of the ball.

A circumstance of much importance, and leading to the knowledge of the place of the ball, is the consideration of the nature of the sensations, and the course of the nerves; and when the operator is about to make an incision for the extraction of the ball, let him observe well how it has entered, and how it lies in reference to the vessels and nerves. A gentleman requested me to be present while he cut out a ball from a young man's arm: the ball seemed to lie superficially, and immediately under the integuments of the inside of the arm. He commenced his operation very inconsiderately, and without reflecting on the course the ball had taken. I had taken a sketch of the arm, plate VII. fig. 2. I observed that the ball had entered on the fore-part of the arm (where the cicatrix of the wound was), and that it must have struck the humerus. I also observed, that on pressing the integuments over the ball, the patient felt a numb-

ness all down his arm in the course of the radial or median nerve. These circumstances made me say, when the surgeon took the knife in his hand, that it would be necessary to go round the artery, an expression which he did not fully understand, for he made an incision directly upon the prominent part of the lead (a ball it could no longer be called). The ball did not start forward, as he expected. He made repeated incisions, until I could see the brachial artery beating under the course of his knife. There was now a deep and bloody wound, instead of a mere touch upon the skin as with a lancet, which my friend thought would have sufficed; and now he said, with much good humour, that he believed I knew best about these nerves and arteries, and put the knife into my hand. I dissected for the edge of the biceps muscle, thrust aside that muscle, and cut through the brachialis internus down to the bone, against which the lead was flattened, while a sharp angle stood up on each side of the brachial artery and radial nerve. It was with difficulty that I got out the rough lead from under the artery without tearing the vessel. Had the original incision been persevered in, the brachial artery must have been cut across. Thus my reader may perceive, that we shall sometimes have to follow the ball in its course, to extract it from its seat under the great vessels.

In all his difficulties, the surgeon has still to hold in his recollection the stages and progress of a gun-shot wound as they relate to operation.

When the wound is first received, the inflammation and pain has not yet arisen. If the ball can be felt distinctly, it is to be extracted. But we have to remember the difficulty of ascertaining the place of the ball, especially if it be flattened and irregular, as when it has touched a bone. If we can touch it with the finger, there can remain no doubt of the propriety of its being extracted. If it can be felt in the part of the limb opposite to the wound, there can be no doubt of the propriety of making a counter opening for the purpose of extracting it. This opening will quickly heal, and it ought to be allowed to bleed freely. In the operation of extracting the ball, forceps will be less useful than the spoon or lever. The forceps, which are generally made for the extraction of balls, often cannot be used; when a simple lever or spoon, or even the common dressing forceps, are useful. The crane bill forceps is a useful instrument. I have received the forceps used in the French armies, and I think them excellent. They separate so, that of their blades we may form levers: — one part of the handle is of a shape to extract balls from the cavities, and the other has a screw suited to extract cloth from the wound. I have sent these forceps to the principal instrument-makers, so that they may be ordered by my readers.



OF THE INFLAMMATION OF GUN-SHOT WOUNDS,

The ball in its passage has formed a dead case or tube, which lining, as it were, the sensible parts, the contact or lodgement of any foreign body is not felt, nor followed by inflammation. The parts immediately contiguous to the deadened surface are benumbed, and there is a pause as it were in their action before the inflammation rises. This is a time when the surgeon can with most freedom examine the wound; but even now a teasing interference, and frequent probing or incisions, will accelerate the inflammation, and bring it on before there is a disposition to throw off the slough. In like manner when the bone is broken, and pieces are driven among the flesh, the inflammation is not only greater in degree, but rises earlier; the wounds made by the bone, being like common wounds, they inflame rapidly.

With the rising inflammation the wound begins to gleet and discharge, and by and bye, that is about the sixth or seventh day, the suppuration is established,

established, and the slough which plugged the wound protrudes. The dead parts have separated, but they still remain in the wound a source of irritation, while they at the same time obstruct the discharge.

From the seventh to the tenth day the slough (that is, the dead cellular membrane,) hangs from the wound like a piece of dirty lint or chewed paper; and although there be a zone of inflammation around the orifice of the wound, there is still an indolent character in it. Mr. Hunter conceived that gun-shot wounds were first scarified to take away bones and extraneous bodies, and that afterwards scarification was continued when the occasion was forgotten. I believe that the idea of scarifying these wounds arose from the apparent indolence, and the slow progress they make, which surgeons thought would be accelerated by giving passage to the sloughs. However that may be, scarifying wounds will be of little service in removing this cause of delay. Among the soldiers from Spain, I have seen some whose wounds were scored, as if in religious ceremony, but the cuts were healed, while the narrow wounds remained full of slough.

When the discharge is free, the wound by and bye clears itself of the sloughs, and the granulations soon shew themselves. Then the wound retains no character of gun-shot wound, unless its depth and narrowness. But as now its surface is alive and sensible in all its extent, if any piece of cloth or sharp point of bone remain, they keep up an

an irritation and gleet discharge, instead of a moderate discharge of good pus.

TREATMENT OF GUN-SHOT WOUNDS OF FLESHY PARTS.

IN the treatment of all wounds, we have to combat a natural desire in the attendants of doing something, and an expectation on their parts that the surgeon has an operation to perform. It requires address to compose the patient, and to convince the friends that nothing ought to be done. Certainly there is nothing in the principles of surgery that authorises the scarifying of a wound. The subject has been ably treated by Mr. Hunter; and there are some excellent examples in favour of doing nothing, in a paper by Dr. Jackson, in the London Medical Journal, vol. xi. The cases given by Mr. Hunter and Dr. Jackson, show very fairly the difference between such wounds as were treated according to art, and the wounds in men who skulking in the out-houses and woods were left to nature. The result was uniformly in favour of those who received no assistance. Scarifying gun-shot wounds of fleshy parts is an unnecessary and useless severity; but a simple and consistent practice is not to be at once established. In the paper which I have just referred to, the author says, it is certainly very proper when wounds run under the skin, that they should be laid open in the whole of their length. Now this also is quite improper. In a practical work on gun-shot wounds, published in this country, advice is given
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to cut freely, and not to spare the fleshy bodies of muscles; the fascia, it is said, is by no means to be spared, and aponeurosis must be cut in all directions like the radiated light of the sun! It is well when extravagance of language is added to heighten the absurdity of this doctrine. But in Mr. John Bell's book on wounds*, there is a force both of words and argument, which is more likely to convey an erroneous notion of the necessity of scarifying gun-shot wounds. I shall not give an extract from a book which should be in the hands of every student of surgery, but be satisfied with stating my opinion in direct contradiction to the rule on this point of practice. One obvious remark occurs on the whole of the passage in favour of scarifying gun-shot wounds, — there are too many reasons assigned for the practice. The short objection to them all is, that we cannot dilate a wound which has been made through the substance of the limb: a transverse, or crucial incision of the skin, will not give room for general swelling; and to open the fascia, by inserting the knife into the wound, would not relieve the limb, though the knife was run down three or four inches. If the question relate to the opening the fascia, in order to permit the general swelling to take place, then it becomes a question in anatomy; for if the fascia is to be slit, it is not to be done by *scarifying* the wound, but by cutting the connection of the fascia to the tendons, or bones, or by

* Discourses on the Nature and Cure of Wounds, 8vo. vol. i. p. 191.

laying that membrane largely open. It is the whole limb which swells up, and not merely the parts around the wound, and therefore, although scarifying the wound may somewhat accelerate the inflammation and consequent changes, yet this is not an object to be desired; for why hurry this stage of the cure, which is mild and favourable according to its slowness, while there is danger of disturbing the natural action by premature excitement? The tension and swelling of the limb is best relieved or prevented by reducing the force of the circulation in it, by the application of cloths dipped in spirits and water.

I hope my reader understands that I foresee cases which shall require the fascia to be cut; that what I contend against is the scarification of the wound in common cases, and that when it is necessary to open the wound, I propose to do it largely and in a decided manner; nay I shall presently show that limbs are lost and patients lame for years in consequence of the neglect of *deep incisions*. But under the head of scarification, I must say a few words more pointedly.

In the latest treatise on this subject, it is said,
 “ When however the entrance of a ball which has
 “ penetrated a fascia will be a depending part, the
 “ orifice may as well be somewhat enlarged imme-
 “ diately, in order to afford a more ready escape
 “ that way for the fluids that will be effused. The
 “ dilatation can be extended afterwards if circum-
 “ stances require it. But where the path of a
 “ shot lies only along cellular membrane, immedi-
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“ate dilatation may certainly be dispensed with.” If this is not bad practice, it is nevertheless useless severity. In these days, when so much more has been seen by my pupils than myself, it would ill become me to boast; but I have seen wounds through the thigh, through the fore-arm, the leg, the wrist, the hand, and in every part of the body without seeing even an apology for scarifying or slitting up the wound; and although I saw the practice both of the navy and army surgeons in these cases, no idea ever occurred of opening the orifices of the wounds. In conclusion, upon this head of my subject, gun-shot wounds do not require scarifications although gun-shot wounds like bayonet wounds, may fall into a state requiring the use of the scalpel to evacuate matter or to take off the increase of tension and pain, which is the consequence of much swelling under the fascia.

GENERAL TREATMENT.

As to what is to be applied to a gun-shot wound, I most commend the practice of the wounded Frenchman, who being left without assistance, put the remnant of a shirt upon the wounded limb and made urine upon it; for indeed we can apply nothing better than a wet cloth. To apply fomentations to the wounded limb, and poultices to the orifice, what is this but to confine and generate heat, and promote a high inflammatory action?

It is a good remark of Mr. Hunter, that bleeding must be had recourse to with great caution where
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inflammation and fever run high, for to reduce the patient in a degree equal to what the action at the time requires will often be reducing him too much for the constitution to bear after the excitement to action has ceased.

If a patient at home and in full blood has received a gun-shot wound, he ought to be reduced by bleeding, and laxatives, and low diet ; but if he has been a soldier, has lost his superfluous fat by the fatigues of a campaign, repose and a simple diet will be for him in the place of medical treatment ; it will be sufficient that he be covered with cloths wet in vinegar and water, or water and spirits. I have said that on receiving a severe wound, the patient often vomits. In the course of the treatment, the same sympathy continues, and the stomach and bowels are influenced by the state of the wound. It is for this reason that when there is an irritable wound, it is necessary to keep the patient on a strict regimen of soups, and light liquid food, panada, rice, &c. He ought to have by him some mild decoction for drink, and laxatives will be required from time to time during his confinement. When the suppuration is established and becoming profuse and weakening, wine and bark will be required and aromatic confection. If there occur restlessness, threatening delirium, a smart purge followed by an opiate will produce quiet. Now instead of cold applications to the wound, as spirits and solution of sal ammoniac in vinegar, warm spirituous fomentations, and tepid solutions of opium, will be found serviceable. And again, when
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there is an extensive open wound which has suppurated, and the edges of the wound become pale and dry, there is probably an accession of fever, which must be looked to, while warm fomentations ought to be applied to the wounded parts.

When the edges of a large wound fall loose, and a thin sanious discharge comes from it, a more generous diet must be given with bark and wine; at this time stimulating dressings are applied, and over them a warm poultice, with occasional warm spirituous fomentation.

No symptom can be worse than when, from an extensive or deep wound, the discharge is like coffee-grounds; for then there is a failure of the strength, a failure of the life of the parts; the discharge is the resolved coagulum of blood, or the blood flowing from the smaller vessels become putrid in the cavities.

Gun-shot wounds even of the muscular parts and integuments sometimes produce abscess and spurious fistula. Whenever this occurs we must attend in a very particular manner to the state of general health. Confinement or bad air, or the sudden change from scenes of interest and activity to absolute inactivity and repose, have affected the powers of the system: It is thus that I would explain the following circumstance; “the healing process was rapid while we were upon the march; proceeded more slowly when we halted; and was in some degree retrograde when we fixed our stations.” In the common soldiers the abuse of spirituous liquors often occasions an unfavourable alteration in the appearance of the wound.

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There are frequently two causes combining to make a wound fistulous, and to produce abscess in the neighbouring parts. Thus the Walcheren fever seizing a wounded soldier, the wound presently assumes a new character, and a succession of abscesses form. The wound in a healthy person would not fall into this state, and the fever of itself would not produce abscess. I was requested to see a young officer, whose case was shortly this: on the 10th of August, in driving in the French who had made a sortie from Flushing, he received a musket ball in the belly above the right groin, happily the ball struck his purse, scattering the money, else it must have penetrated into the abdomen. The ball entered under the integuments and came out on the fore part of the belly, a part of the purse was found in the wound.—Until the rising of the inflammation, he had rather an uncomfortable sensation, than pain, and when the wound inflamed he was bent down. On the passage home, his wound seemed in a healing condition, but soon after a swelling rose in his groin, which burst and discharged thin matter; the sore extended rapidly, so that when I came to him, the probe passes from the sore in the groin towards the inside of the thigh, and here an abscess formed anew, which threatened to work down on the back part of the thigh. I introduced the long probe, and cut upon its point behind the head of the gracilis muscle, and, introducing the bistoury at this opening, I exposed the sinus which extended down the thigh; I now put compresses on the sores in the belly and groin, so that the weeping discharge from them
ceased.

ceased. But I could not in this way finally cure my patient, the sores in the thigh still remained open, and this forced my attention more particularly to the state of his health, which my reader will now perceive should have been the first object. I found that he had attacks of fever in the night, which were not to be explained from the circumstance of the wound. I thought, on the contrary, that the fever influenced the wounds, and made them troublesome and slow of healing. It was now that my patient told me that the wound was at one time so well, that he was able to walk about the streets of Middleburg, when suddenly one night he was seized with headach and giddiness, for which he took a soldier's remedy, brandy and a warm blanket; but some days after he had a return of the attack, and the fever increased with sleepless nights, difficulty of breathing, headach, and delirium. I now saw what it was that had retarded the healing of the wounds, and by attention to the fever as well as the wound, the abscesses healed. I mean by this detail to remind my readers of the necessity of attending to the epidemic of the season or the country, for the influence of disease will show itself in the complexion of the wound before it becomes remarkable by its prevalence in the camp.

TREATMENT OF GUN-SHOT FRACTURES.

WE enter on a subject which is very important and difficult, and even of some delicacy. Every
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young surgeon, when he finds himself in the field, expresses wonder that he so poorly conceived the nature of gun-shot wounds from reading and the instruction of his teachers; and he adds, what can a lecture in a London theatre teach of this? When the same gentleman returns to us familiar with the horrors of the scene he has witnessed, and proud of the dangers and difficulties he has passed, he feels the subject his own, and an attempt like this, perhaps an encroachment.

But when with every sentiment of respect for practical knowledge thus honourably acquired, we here at home seek to profit by the knowledge of the military surgeon, we find it withheld, and that there is nothing written by them upon the subject. Their apology is, that a man must see and not read. I know very well, that a man will neither learn anatomy nor surgery by reading: but, on the other hand I affirm, that, without reading, the mind of the young-surgeon, amidst the fairest opportunities, shows only a little short-lived curiosity during the novelty of the scene, be it the dissecting-room, the hospital, or the field, which soon relaxes, and leaves him inert and indifferent.

One may indeed augur, that he who shows no desire to know the sentiments of those who have preceded him, in a profession so interesting as ours, will have the same heaviness of mind, and show the same indifference when occasions of personal observation offer. I do not recollect to have learned much of gun-shot wounds before seeing them; but by much reading on the subject,

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I was prepared with many questions ; by long trying to form an idea of their peculiar character, I was prepared to seize with avidity every opportunity, and to observe with attention every change, which I would not have noticed, or would have considered trivial, had I not previously strained to comprehend them by reading. To prepare my reader for observation, when occasions present themselves, is my humble endeavour here ; to endeavour to place the subject in its true colours, however faint they may appear, and to try to put the questions of difficulty into such shape, that when the cases do occur, he may be the better prepared to observe and arrange, that his attention may be more intently fixed, and the progress to judgment somewhat accelerated.

Nothing is more apt to deceive than the feeling of bones shattered by gun-shot. We touch a splinter with the point of the finger, or feel it loose to the probe ; but if we attempt to draw it away with strong forceps, we find, in all probability, that there has been a splitting up of the bone, and that we have got hold of a very principal part. Even when loose, these pieces are found to require extensive incisions to extract them, or the parts are torn as the pieces of bone are drawn forth. I question very much the propriety of tearing away even lesser pieces, when they adhere firmly.

The surface of a bone may be struck by a ball so that the ball is flattened on it, and yet no exfoliation of the bone takes place. I cut out a

ball from the arm seven months after it had struck the humerus, and although it was flattened on the bone, the bone was not injured. I have seen the head of the humerus struck by a ball, which ball I found in the muscles of the back, as if divided, and yet no exfoliation took place. When the surface of a skull is hit by a ball, there is undoubtedly great danger, but still nothing is to be done in the way of operation; the skull will often escape unhurt, having suffered neither contusion, nor such injury of its surface as to make it exfoliate. My pupils have related many cases to me where they have seen the skull struck by balls without a bad symptom; but lately, I have myself seen three cases of this kind, in one of which the ball was flattened, and passed two inches under the scalp, and yet there was no injury to the skull. But where the danger is so imminent; and where, if symptoms of an affection of the brain be allowed to commence, it is so seldom in our power to stop the progress of suppuration: it is of the utmost consequence to watch, and keep the patient low.

There is a considerable difference of character between the gun-shot fracture of the cranium and the fracture from a bludgeon, or from the head striking the ground; the fissures do not in the former case run so extensively from the shattered center; the injury is more local; the fractured pieces are smaller, and more numerous; often comminuted. In taking away these pieces, the trephine will seldom be necessary; yet let me
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here guard my reader against forcibly pulling away the pieces of the broken skull, for if he tear the dura mater, a new and more dangerous injury is committed.

When a ball strikes the cylindrical and middle part of a bone, it will break it into many pieces; but if it strikes the head of a bone, it will enter into it. If, in putting the finger into a shot-hole, where the ball has struck the center of the bone, many bruised pieces are found, — if the ball has not merely hit the bone and struck off splinters, but has passed through its substance, then the case becomes more grave and important. The suppuration not only takes place amongst the soft parts, but in the center and medulla of the bone; a bad discharge comes from within the bone; the shaft of the bone dies, and a kind of imperfect and irregular necrosis is formed. The old bone does not unite; new bone is formed round both pieces; the sequestra remain loose, and yet so wedged in, that it cannot be taken out, so that it becomes a tedious source of irritation, and after months of suffering, amputation is often at last had recourse to. I shall presently return to the consideration of this case.

There is a marked distinction, however, betwixt the case of fracture, such as I have just alluded to, and where the ball does not *perforate* the bone with unsubdued violence, but merely breaks it; and there is of course a great difference betwixt the ball perforating the arm bone, the thigh bone, or tibia, and when the bones of the fore-arm, or the

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fibula,

fibula, are broken. I have seen the arm amputated on account of the shattered state of the ulna; but this was quite wrong; for before and since I have seen worse cases do well, with only common care. Nor is the combination of a shattered radius and a torn radial artery a case for amputation.

It does not, in all cases of balls entering the heads of bones, follow that they pierce or lodge. I have specimens of all kinds of fractures by gunshot; and amongst them of the head of the humerus shattered to pieces. In Haslar hospital there lay three men with the heads of the humerus shattered by balls; there lay many too struck about the shoulder-joint. If a man be struck on the top of the shoulder, as represented in plate VII.; and if, upon laying the hand over the joint, and moving the arm, the bones are felt jarring; and if the bones are not merely fractured, but we discover by the finger in the shot-hole that they are crushed, it is considered very improperly a case for amputation at the shoulder joint. This is also a case which requires a distinct consideration.

When the ball enters into the lower head of the femur, and lodges, we may be long in suspense. By and bye the whole limb inflaming, and becoming greatly swelled, an abscess forms, perhaps, in the calf of the leg; we are then tempted to think that the ball has fallen down to that place, and that the abscesses being opened the ball will be found. But I have twice found this to be a great mistake; the ball has stuck in the bone; it forms a source of great irritation; that irritation
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is not immediately shown by its effects on the bone, but on the surrounding soft part of the limb, and, as I have said, on the part of the limb below the seat of the ball. This swelling and great abscess in the leg, on dissection, shows that the cavity of the abscess is not formed in the cellular membrane; but the inflammation goes so high that the very texture of the muscle is destroyed. Besides this consequence of the injury to the bone, there is another effect to be taken into consideration, namely, the swelling of the knee-joint; although the capsule of the joint be not opened, yet the ball being socketted in the head of the femur, or tibia, the effusion into the joint will be converted into purulent matter; on dissection, after amputation from such a cause, I have discharged six ounces of pus from the knee-joint. The ball immersed in the lower head of the femur followed by these consequences of violent inflammation, and in an exhausted subject, gives occasion to amputation.

In plate VII., I have given a sketch of a man wounded in the shoulder; and, in plate IV. fig. 1. and 2., I have represented the shattered head of the humerus, which I dissected out after amputation. I have already described the appearance and the feel of the shoulder when that head of the bone is fractured by a musket ball in this manner. We have now to notice the effects: high inflammation, enormous swelling of the arm and shoulder, deep and extensive suppuration, large sinuses, dead bones discharging, and the patient

dying hectic. Such are the consequences; and these considerations presented to the surgeon's mind, he at once condemns the arm to be amputated at the shoulder joint, when he feels the bones crushed, and like a bag of sand under the deltoid muscle.

Such is the rule of practice in both army and navy, and I have seen the surgeons of both departments united in consultation, and in operation upon such subjects. Yet I am confident, this is not the right rule of practice: for, let us observe, that a ball through the deltoides is nothing. I have seen a man wounded by a ball passing betwixt the acromion scapulæ and the head of the humerus, where there was no necessity of doing any thing but giving him a bed to lie on. It is the fractured bone which creates the great inflammation, the suppuration, and sinuses. Now suppose, that instead of performing that very serious operation, the amputation at the shoulder joint, a decided and long incision be made through the deltoid muscle, the loose bones picked away, and the broken extremities of the humerus taken off with a small saw, what will the situation of the patient be? The operation is easy, not severe to the patient, and the cause of high inflammation and protracted suffering is removed. The arm is undoubtedly shortened, but it remains a useful member. When I see so many fine fellows mutilated by this too favourite operation at the shoulder joint, I feel that I cannot express myself too decidedly on this subject. This comes of want of principles.

principles. The surgeon sees the terrible effects of gun-shot wounds, without contrasting sufficiently the case of a wound of a fleshy part with a wound of the bone, without therefore seeing that it is the bone that occasions all the mischief, without therefore thinking of removing the bone, and reducing the wound to a state comparatively simple.

I must next request my reader's attention to the figures 1., 2., and 3. of plate III. They represent the effects of a ball striking the middle of the humerus. When I saw the patient to which the bones fig. 1. belonged, I could introduce my finger into the shot-hole, which was exactly in the middle of the humerus. I have heard it thus stated, when the bone is fractured by the ball striking the bone, the arm is to be saved; but when the ball goes through the bone, and the finger introduced into the shot-hole, feels the broken pieces on all sides, and that the ball has passed through the cavity of the bone, it is a case for amputation. Let us examine the foundation of this opinion: —

The arm swells to a great size, the inflammation rises slowly, but arrives at a very high degree; abscess forms; and when the matter is discharged, and the tension relieved, deep spurious fistulæ succeed, and break out from time to time, preceded by an attack of fever, and with increase of suffering. The patient is harassed for a long time, and for years pieces of bone are discharged. If, after years, an opportunity is given of examining the bone, it resembles that represented, fig. 2.;

a necrosis is formed, and the sequestra, fig. 3., has kept up the irritation for this great length of time.

Seeing this to be the state of the bone, and the bone the cause of the prolonged suffering, a question arises, whether there be any better mode of averting these consequences than by amputating the limb? In my opinion the practice is obviously this: make a deep and long incision down to the fractured bone, pick away the loose pieces; let those which are long and adhering to the membranes remain till thrown off by the suppuration; dress the wound with lint dipt in oil, so that the lips of the incision do not contract, nor the matter and slough be in the slightest degree retained; lay the limb on a wooden or tin splint, and apply wet cloths to the whole extremity. That the cure will be slow must be a necessary consequence, but the evils already enumerated will be avoided, and instead of years of suffering in the state represented, plates VIII. and IX., or the loss of the arm, the patient will preserve a useful member.

My reader will do me the justice to distinguish betwixt this decided practice in certain cases of fractured bones, and the scarification of gun-shot wounds in common cases. The Russian soldiers in the hospitals around Paris at the end of the war, were treated in the manner I have described, and their wounds, when compared with the state of the limbs of those who had been treated differently, proved in a very marked manner the superiority of the practice.

OF LONG CONTINUED SINUOUS ULCER, AND OF NECROSIS
FROM GUN-SHOT FRACTURE.

WHEN there is continual irritation from a number of loose pieces of bone in the very center of a limb (the consequence of a practice opposite to what I have recommended above), and when this endures for many months, nay, for years, we must expect disorders of the constitution to be the consequence, and a reflected influence from this upon the ulcers. We shall have occasion to remark how irregularities in living increases the irritation of the sores, and produce temporary increase of swelling in the limb. When the general swelling increases, leeches and cold cloths are applied to subdue the inflammatory tension. There follows, perhaps, a pricking pain in the bottom of the wound, and some small pieces of bone are felt; they are extracted, and give relief. Now it appears that these pieces of bone have been the cause of the deep pain, and general swelling, and the drying of the ulcers. But it is not always so. Often it happens that the inflammation has arisen from disorder of the system, from cold, debauch, or irregularity of any kind. Pieces of dead bone, which in the quieter state of the limb did not prick or irritate, when the system is thus disordered become a source of irritation.

The confinement and the depression of mind, especially in wounds of the lower extremities, will bring on a state of torpor in the venous system of
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the intestines and liver, which must be relieved ; after which warm stimulants to the stomach and intestines will show a favourable influence on the wounds, by a diminution of the irritability of the sores. When the limb swells, and the sores become of a dark fiery colour, the holes enlarge, (and this is a change which will take place from time to time,) we ought not to bleed in the arm, though we may apply leeches to the limb, if the state of the pulse admits it ; always, however, remembering, that this is like an occasional exacerbation which will subside, and leave the patient exhausted and languid. It is therefore best to use such applications as will most effectually relieve the inflammatory action of the part, without lowering the strength of the system. Dip cloths in spirits, and apply them to the limb, not to the part only, but over the whole limb. By this the arterial action will be materially diminished, in a night's time the swelling will be so much lessened, that the skin will be corrugated, and the sloughing disposition checked. This means of subduing the arterial action will be found very effectual when there prevails that sloughy disposition in a gunshot wound, which endangers the coats of the neighbouring great vessels, and secondary hæmorrhage.

I have witnessed the effects of irregularities in officers who have had the long bones thus shattered and necrosis formed, but chiefly in the common soldiers sent up to Chelsea, have I noticed the consequence of this debauchery, when freed from
from

from the controul of discipline. In the men from whom I took the sketches, plates VIII. and IX., this was remarkable: in the first of these, several attacks had been sustained from which he had recovered; and in the latter, I have endeavoured to represent (which in an etching it is impossible to do truly) the effect of this sudden change of disposition in the wound. This young man had received a ball through the humerus, like that in plate VIII., and many others in the same detachment; the fracture had been improperly treated. Suppuration and discharge had taken place at A, and in succession at B, and again at C; after which the swelling and inflammation had so much subsided, and the wound being diminished to a weeping sore, he was sent off to be discharged. But when I saw him, the wound was beginning to open, the arm to inflame; he was hot and feverish, and sick, and the sore rapidly extended, and became foul and sloughy. It is such consequences from wounds of the bone that makes the army-surgeon so easily persuaded of the necessity of amputation; but which, I have already said, may be avoided by deep incision to the fractured bone, when the wound is first received. I have seen a wound of the os ilii, where the ball lodged betwixt the bone and the iliacus internus muscle, take this disposition upon it, and carry off the patient in a few days, after it was thought he was entirely out of danger.* When this disposition shows itself, I have

* I shall here transcribe my notes taken at the time, as expressive of my perplexity. " In the hole E I can feel the bone
rough

have seen benefit, from emollient fomentation to the limb of decoction of poppy-heads, and applied tepid to the whole limb; after attention to the bowels, bark, with an aromatic, during the day, and James's powder, calomel, and opium in a pill at night.

OF NECROSIS FROM GUN-SHOT FRACTURE.

Is there nothing to be done for a patient who is suffering from an ulcer, out of which pieces of bone are successively discharged, twenty or thirty in the space of a year? As long as there is no

rough and spongy. I think I can distinguish the surface of the ball. The patient cries out when I endeavour to move this part. It is better to desist at present; the wound and constitution being so irritable. There is great mark of irritability in that flushed face." — "29. I know that I shall be mortified hereafter, if I find an irregular piece of lead sticking in the bone." — "30. This fine fellow must soon die, his face is still rosy, but he has pain in his chest, his breathing is affected, and his pulse weak and trembling." — "I think now that we should have attempted something more." — "The ball certainly has not entered into the pelvis." — "The ulcer spreads; the center sloughy and foul; the edges more irritable." — "It is painful to think, that by the extraction of the ball a source of irritation might be removed. — But would its extraction be attended with advantage? Certainly not now." — "If all this mischief is to be attributed to the presence of the ball; how was it that the wound was not larger than a shilling until he came here? Is it not the journey, the free living of a discharged soldier, or the bad air of the hospital that is the direct cause of this disturbance?" The preparation is in my collection, showing another example of the ball piercing the bone, but unable to go further into the soft parts.

great

great disturbance, I take up the case, and treat it as I would do a scrofulous affection of the bone, keeping the surface of the limb in activity by embrocation with warm oil and by fomentations, while the bowels are kept in action by a combination of laxatives and aromatics. The spongy ulcer may be washed with tincture of myrrh. Often the spongy fungous ulcer will heal over the dead bone, but the skin is not healthy, it remains thin and red, and tender, and is ready to break out again into ulcer. There is a rule of practice, which I would offer to my reader upon this subject, which is one I think he will not soon arrive at by experience. When a dead piece of bone is felt in the bottom of the sinus, and which cannot be brought away, the dresser stuffs the sinus, thinking that it ought to be kept open as the means of extracting the bone upon some future occasion. But the effect of this is a kind of inflammation in the bottom of the wound, which consolidates and binds the piece of bone more firmly. If, instead of this, the integuments are allowed to heal over the sinus, a soft abscess forms without irritation or much hardness, and the dead portion of bone is separated and lies in the abscess, and the more slowly the abscess makes its way outwardly, the more easily is the portion of bone disentangled.

Even in the case of necrosis, that is, where a new bone is formed round the old one (see fig. 1. pl. III.), and the latter is a perpetual source of irritation, we ought not to accelerate matters. There is a time when it will be proper to interfere to some decided purpose.

When

When many small pieces of bone have been discharged, when, after much pain and long suffering, the limb feels as if there was a bone in it of double or triple the common diameter; when at last a firmer and larger piece of bone is felt projecting, and when that piece of bone, though loose, cannot be extracted, the patient may be relieved, and a final cure obtained by the operation of trepan.

A long incision is to be made down to the bone, laying bare from three to four inches of it. The opening of the new bone, through which the sequestra or remnant of the old bone projects, is to be fairly exposed. The trepan, or trephine, is then to be set on the new bone, a little behind the opening, so that only a small portion shall remain betwixt the artificial opening and the original one. This being broken down by a strong knife, (which will be found quite sufficient to perforate the new bone,) room is afforded for elevating and withdrawing the sequestra, which we are to hope was already separated, and only retained by the smallness of the hole through which it projected. The limb must be covered with a wet cloth, and evaporation permitted to keep down the rising inflammation, for the operation is a very severe one, and may prove serious in a bad constitution.

OF WOUNDS OF THE JOINTS.

IN plate X. fig. 2., I have given a sketch of a wound of the knee-joint: the ball struck the bone so obliquely, that it just opened the capsule, and
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went out through the integuments. Here is the very slightest possible gun-shot wound of the knee-joint, yet this man suffered amputation. When I dissected the limb, the knee-joint was full of pus; the quantity was so great, that it showed it had been confined. I cannot venture to say that amputation was improper in this case. But I must give my opinion, that the wound should have been dilated, and the purulent matter permitted to escape, before the necessity of amputation was declared; if, after this, the high inflammation should be succeeded by discharge, with the continuance of pain and fever, and night sweats, so that there is no hope of the constitution rallying, that, in short, the patient is sinking from hectic, which cannot be checked, then amputation must be had recourse to.

But I would not have my reader suppose, that because the knee-joint, merely opened by a ball, shall in one instance give occasion for amputation, that therefore, *à fortiore*, a ball through the knee-joint, or piercing the joint and sticking in it, must form a case for amputation. The treatment of gun-shot wounds of the great joints is a subject of much importance, and I would be happy to have recourse to authority; but our authors on this subject have left the question of amputation for gun-shot wounds of the joint in the same obscurity they have done the other important practical questions.

In fig. 1. pl. X. we see the ball has struck the inner condyle of the thigh-bone, in such a manner

as to open the capsule at the same time. This represents therefore a case of a ball entering and lodging in the knee-joint. Plate XI. fig. 1. A, represents the appearance when I dissected out the bone, the ball is seen sunk into the bone. This man's leg was amputated, and I think properly: I entreat my reader's attention to the special reasons. The influence of this wound, and the lodgement of the ball, had produced its full consequence unchecked by treatment. That prominence at A was a bag of matter: pus was in the knee-joint. The patient was exhausted by hectic fever. When the limb was amputated, and I had an opportunity of dissecting it, I found the knee-joint containing much green pus, and the whole muscles of the calf were as if bruised, and in the midst of the bloody mass of effusion there was a large irregular abscess. It is therefore certain, that this patient could not have recovered without amputation. But again observe, that this was a consequence of high action which ought to have been subdued; and, therefore, such a case does not decide the question of amputation in recent cases of gun-shot wounds of the knee-joint; it only proves to us what will be the consequence of omitting to subdue the inflammation.

I have given the sketch, plate XII., to confirm in my reader these facts. The ball entered into the head of the tibia. The forceps are represented introduced into the wound, where I and others thought we discovered the ball; but the ball had traversed the bone and lay on the other side, out
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of reach of the instrument. The bone, with the ball, is represented in plate II. fig. 2. This patient was in every respect in the same state with the former; in the knee-joint there was much pus collected, and the muscles of the calf at A contained a bag of matter, surrounded by blood extravasated by the violence of the inflammatory action. This patient would have soon sunk under the effect of irritation and hectic fever.

Such narrations do not decide our practice in cases where a musket-ball has penetrated the knee-joint. Let me state the occurrence in another form: a gentleman is shot by a highwayman through the knee-joint. The patient is carried to the next inn, and the surgeon has an opportunity, not of subduing inflammation, but preventing it. The patient is bled largely and repeatedly, and the limb is covered with wet cloths, and kept in perfect rest. The probability is, that every thing goes on prosperously. But my reader is to expect threatening symptoms, and such as will make the patient, and the friends, suspect the propriety of this practice; inquietude and distress of mind, and convulsive shuddering of the frame, announce the injury to the constitutional powers, and that although you check the rising inflammation, you cannot protect the system from feeling the shock of the injury. Those will be subdued by opiates and aromatics, while the cold applications are to be managed, but persevered in.

When a ball enters, and is lost about the knee joint, the inflammation, if permitted, will rise

very high, endangering life. When the influence of the wound has subsided, and the swelling has diminished, and the inflammation which extended all over the limb becomes diminished and limited, the presence of the ball is still a source of irritation, especially if the shot holes, or the sinuses are kept open. But even when they are permitted to close, the bone remains subject to inflammation, and on every attempt to move the joint there rises fever and inflammation. The patient's health is broken; he is pale and subject to a hectic flush. On examining the joint, we find effusions into the sheaths have consolidated all the parts, and we are apt to think that we feel the ball lodged. We are tempted to make incisions, but from this we must abstain until the suppuration leads us to the place of the ball, or until it can be distinguished from the thickened ligaments.

When a ball is lodged about the body or limbs, we are not to make incisions in search of it. The ball lies inoffensive: if deep seated, it does not excite inflammation; if superficial, it will work to the skin, and inflammation and abscess will betray its seat in good time. The rule is not so simple in its application in regard to balls lost about the knee-joint, but it is the same. We must not cut to search for the ball, nor use the trepan upon the bone, unless we are certain that without much disturbance to the joint it can be extracted. By the detail of the following case, the subject will be brought before my reader in all its difficulties. —

A foreign

A foreign nobleman leading his regiment to the attack of a French position at the battle of Borodino, having his right side to the enemy, received a ball in the most prominent part of the inner condyle of the left femur; it threw him down, and he was carried off the field. In the same day, he lost his elder brother, and his younger brother won high honors. The magnitude of the stake, the unexampled numbers engaged, account for this wound being only slightly dressed, and no attempt made to extract the ball, or to ascertain its exact position. By the dispositions of the armies which followed this great battle, and by the occupation of Moscow by the French, his soldiers were constrained to carry him from place to place during the period of the rising inflammation. The swelling and the inflammation of the thigh, knee, and leg, rose to an excessive height. The immediate consequences of which, were extensive abscesses in the thigh, from which they in vain expected the discharge of the ball. When the violence of this first inflammation subsided, and the abscess of the thigh closed, the surgeon kept open the original wound. — It was a considerable time after the attempts to discover the lodgement of the ball in the thigh, that in dressing the wound the probe was found to pass in a new direction, and being introduced to the extent of four inches, the ball was felt firmly fixed in the lower head of the femur. The object now was to extract the ball, and he suffered various attempts before he was sent to England. From

Petersburgh he followed the armies into France, and from Troyes, the whole Russian army being then on the advance upon Paris, he was, by the affectionate regard of the Emperor, conveyed to London.

When the General arrived in London, he suffered much from the effects of his journey, and his health was broken by the long irritation of the wound.

He had a countenance of much suffering, his pulse was irritable, and he was subject to frequent attacks of fever, ushered in by rigors, without being aware of their connection with the state of the wound.

The examination of the wound was made with gentleness, on account of the irritable state in which the General was; but even the introduction of the probe, and merely touching the ball, brought on an attack of fever; and by the advice of his Excellency Count Leiven, he was removed to lodgings in the country.

I ought to state here, that although I felt the honour done to me by this excellent man being put under my care, yet I construed the terms of it, and the expressions of interest in the General's situation, by his august Majesty, as a call upon me, not to proceed according to my unaided judgement, but to take the opinion of the profession of London.

My object was, by rest and quiet and a free air, to restore my patient's health, hoping that he would acquire constitutional strength, to permit
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me to make a thorough examination of the wound.

In a few weeks his natural good spirits, and the strength of his constitution, restored him so far, that I was enabled to make an accurate examination of the situation of the ball.

The General stood, as I have said, with his right side to the enemy, looking backwards to the column which he commanded, when the ball struck the inner condyle of the left thigh-bone, exactly upon its utmost convexity. The probe being introduced at the wound, passed three inches and a half, when the rub of the ball is felt; the probe passed a little oblique downwards, traversing the substance of the inner condyle.

When I took into consideration the size of the bone, the depth and direction of the probe, and the circumstances of former cases, I was of opinion that the ball had been arrested by the root of the crucial ligament, where it is attached to the notch of the femur. The ball must have opened the joint, but it did not enter into it, and it remains very firmly impacted on the inside of the outer condyle, in the corner of the notch, and at the root of the crucial ligament.

Having ascertained the situation of the ball, I saw the great difficulty of the case. I called a second consultation, hoping that my friends would agree to my idea, which was to trepan the femur, and extract the ball. They saw much danger in the operation. A proposal was made to enlarge the wound of the skin, by touching the lips with lapis infernalis (kali purum).

The caustic was applied, the wound was a little enlarged, but there came on a very severe attack of erysipelas, which extended upwards to the groin, and downwards to the foot, with much fever. This very serious consequence of a slight touch of the caustic, proved more than any thing the deranged state of health; and, I confess, had its influence in finally inducing me to agree with the opinions of my brethren. Cold applications were used to the limb, bark in decoction was given, and antimonials at night. The General at this time suffered much, and his life was in danger.

Upon his recovery, I made various attempts to extract the ball, or to dislodge it, and bring it forward. I found this very difficult, from the depth of the ball, and the sensibility of the parts in which it was lodged, and I had an opportunity of observing the effect of the wound upon the constitutional powers; for whenever I disturbed the ball by considerable efforts, the fever rose twenty-four hours after, with tumefaction of the limb and erysipelatous blush. By such appearances I was long kept in check. My object was latterly directed to the fixing an instrument upon the ball, with which it might be drawn and solicited forward, so as to work its way through the bone. I was aware that a change must take place in the general constitution, before any violent and decided attempts were to be risked. By this repeated interference with the wound, I saw the General's constitution irritated, and I desisted.

Giving

Giving my patient rest, and continuing to attend to his general health, I waited until he was so far recovered, that the question of the propriety of a decided operation might be again discussed. I called into consultation the most eminent surgeons of London: we met; and the event of this consultation was unexpected to me, for tents were proposed.

Now the use of tents to dilate a hole three inches deep in a bone, I could not countenance, and my patient having suffered very much from such attempts in Switzerland, refused his consent to suffer a trial from which he had no expectation of success.

I, for the last time, called the attention of my friends seriously to my patient's situation. They were decided against the operation. The General himself now took alarm, at seeing so many were of opinion that his life would be in danger, and although his confidence in me made him say, he would suffer all in my hands, I did not think I was at liberty to urge the operation.

We now united in opinions that the wound should be permitted to close. My expectation from this was, that the ball would be inclosed in a consolidated mass, and that with the leg kept extended, and the parts by that means preserved from attrition against the ball, my patient would regain, in a very considerable degree, the use of the limb.— In this expectation I have not been disappointed.

I must

I must add, that if hereafter suppuration shall take place, then happily the matter will find a passage into the ham, and afford the surgeon an opportunity of extracting the ball without perforating the bone. I had the pleasure to see him before he left England, with the wound closed, the fever entirely gone, and the health, flesh, and colour returned.

I have seen the arm amputated for a ball through the wrist joint; but so I have for a ball through the small head of the ulna, and in both instances, the operation was altogether improper. The excess of fungus which is thrown out from such wounds, with shattered bones, betrayed the surgeon into a belief that the hand should be amputated. The patient will recover when a ball passes through the foot or ankle joint, or elbow or shoulder joint; such cases I have repeatedly seen. Unfavourable circumstances will sometimes bring these wounds into a state requiring amputation. I have seen a wound of the lower head of the fibula fall into a state which demanded amputation; but from such occurrences we do not draw the rule of practice, they form exceptions.

When there is a bad wound of the joint, with a wound of the great vessel, or nerves, a necessity of amputating the limb may arise from the complication. How the wound of the nerves shall influence our decision on the case, may not so readily occur to my reader's mind. I give the following example:

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An officer consulted me as to the propriety of amputating his arm ; the case was this : In storming a fort in the East Indies, they were driven back with great loss, many of the men being wounded, and many of them scorched by the blowing up of bags of gunpowder, which the besieged had laid in the breach, covered with straw. A native soldier made a push at my patient's breast with a spear, which he received in his left fore-arm ; the point struck the head of the radius, and broke it. Soon after he received a ball in the elbow joint, not an inch from the first wound ; the ball struck the olecranon, entered the joint, and the tendon of the brachialis internus stopped it, on the fore part of the joint. The arm inflamed very much, and successive abscesses were formed in the muscles of the fore-arm ; the joint became immovable ; the arm wasted in an extraordinary degree ; the arm and hand were without feeling, and the thumb and fingers were incapable of motion. Since the closing of the wound, the arm was covered with a scabby eruption. The arm stuck so awkwardly before him, it was so shrunk, stiff, powerless, and insensible, that I did not wonder that he wished it off, although he no longer suffered from pain.

The remark which this case naturally draws forth is, that when the nerves are thus cut to the certain loss of sense and motion, when we are certain that the use of the limb cannot be regained, we find no adequate reward for carrying our patient through the tedious cure ; it is better to amputate in the first instance.

OF THE TIME FOR AMPUTATION IN CASES OF GUN-SHOT
WOUNDS OF THE EXTREMITIES.

THE French surgeons accuse us of delaying the operation of amputation too long, and by that losing our patients : they say that the French prisoners taken in our naval engagements, die in consequence of the operation being delayed until the ships get into port. I do not find that there is any foundation for this. The head of the naval department of the service knows as well as any man the necessity of early amputation, and the practice prevails also with the army-surgeons. But the curious circumstance is, that it is from the French that we are chiefly alarmed by the consequences of operating while the cold and benumbing influence of commotion is present in the limb, and the constitutional powers are suffering from the violence of the injury. They urge, (and, I confess, the arguments have had some influence upon my judgment,) that while the body is suffering under a violent injury, while the powers of life are suffering, a second violence, viz. the amputation of the limb, is too much, and the patient sinks under it.

This is a fact of very great importance to know, but it does not prevent the immediate amputation; and if the knife could follow the shot directly, it would be the more effectual in preventing the accession of those symptoms which have been described as consequent to the commotion of the limb. That large bolt or hook, which may be
seen

seen among my specimens of fractured bones, was drawn out betwixt the bones of the leg of John Thomas of the Minotaur after the action of the Nile. It was buried in the leg, and when the seaman was brought to my friend, he thought it was a piece of detached bone elevating the skin. An incision was made upon it, and this piece of iron, weighing fifteen ounces, was drawn out from betwixt the tibia and fibula. It had entered behind, and stuck between the bones. — A few hours after the extraction, mortification took place upon the foot, showing itself in large vesicles of bloody water. Twelve hours after the action, the limb was amputated, but he never rallied, and died on the third day.

I require to take this piece of iron in my hand, and feel its weight, before I can form an idea of the shock the limb must have sustained by arresting this mass driven from the mouth of a cannon. It is not the part touched, but the whole limb sustains a shock; and in amputating, in such a case, the patient has not the usual sensation of acute pain; he bears the operation, as we would say, well, until by the observation of the countenance, by the hiccup and vomiting, you find that there is more physical insensibility to pain, than courageous sustaining of his suffering.

I have long considered the difficulties of this question, (once let me again say, neglected in our practical works upon the subject of gun-shot wounds,) and the facts lead me to this conclusion, that

that we are to delay an amputation until we see the spirits and animation somewhat returned ; that we are to endeavour to rouse the powers of life by cordials, to sustain this second injury. — But the most attentive consideration of the circumstances do not, in my mind, authorize us to defer the operations of amputation to the second period ; that is, until suppuration be established.

I shall now touch upon another question of importance, and commence my statement with a case given to me by a gentleman high in the medical department of the army.

Previous to the disembarkation of our army on the coast near the Helder, on the morning of the 17th August, 1799, the frigates and gun-brigs scoured the beach with shot and shells to cover the landing. A shot struck a Dutch rifleman, and carried away the left arm by the shoulder. The man was found lying on the sand hills, about a musket shot from the beach. In passing forward with the army, the state of this poor fellow attracted notice. The shoulder, that is to say, the head of the humerus, was completely blown away, and also a considerable portion of the scapula, and the half of the clavicle. The surface of the wound exhibited a horrid spectacle of ragged muscles and fragments of bones. The axillary artery was looked for in vain ; and the case being considered desperate, nothing more was done than to cover the wound with some lint, so as to defend it from the drifting sand. The army pushed on after the enemy, and the poor creature was left where he

lay till the afternoon, when he was placed with the other wounded under a tent. The night was very cold; a good deal of blood oozed from the wound, but there was no gush or arterial stream. In the afternoon of next day, he was removed on a cart to a village two or three miles distant. My friend did not see him again till November, when he met him with other prisoners, who were returning from the hospital at the Helder, a convention and exchange of prisoners having taken place. The recovery of this man was to be attributed to circumstances in themselves distressing, cold and abstinence from food; for excepting a little cold tea, or cold water, he had nothing for the first forty-eight hours. It often happens that the wounded do well under such privations, who would have bled to death, or their wounds run into inflammation, so as to destroy them, had they been nursed amidst the comforts of private life.

It will now appear to my readers, that in the case of limbs torn off from the body by cannon-shot, we shall have nothing to do further than to seek and tie the great artery, and to put the flaps together, and keep the patient very cool and low. But something more may be required. In the battle of Corunna, Colonel M. had his arm shot off at the middle of humerus; the bone stuck out in shattered pieces, and the integuments were ragged and uneven. The surgeon, however, cut away the bones, and dressed the loose integuments. When I saw him, it was on the tenth day after the battle. He was reduced to the last stage of weakness;

ness; sick, languid, and desponding. The arm was much inflamed, the stump was spongy and loose, and gaping with a profuse thin discharge, so that he had the prospect of protracted suffering; and this will be the consequence of neglecting to perform the operation of amputation, instead of being satisfied with cutting off the shattered bone.

Do not let the young surgeon suppose, that he has it always in his power in such cases, to perform the amputation with the double circular incision. It will, in general, be more convenient to form a flap, and that flap he must adapt to the form of the wound.



Οπισθοτονος.

Sketch of the oposthotonos from gun-shot fracture of the skull.

EXPLANATION OF THE PLATES

or

GUN-SHOT WOUNDS.

PLATE I.

IN this figure two wounds are represented, which however were inflicted on different men. These were taken as examples of the difference in the state of the slough of the two orifices. In the wound of the integuments of the belly. A marks where the ball entered. B where it made its exit. In the wound of the testicle, C marks the orifice where the ball entered. See page 15.

PLATE II.

Fig. 1. The lower end of the femur. A the ball sunk into the outer condyle, the bone is slightly fractured, the ball retains its figure.

Fig. 2. The head of the tibia pierced with a ball. A the hole by which the ball entered. B the ball where it has made a passage through the bone, but has been detained by the ligamentous connection. See what is delivered on this subject, page 17. These are examples of balls penetrating the cancelli of the extremities of bones.

PLATE III.

Fig. 1. In a gun-shot fracture of the humerus. We see here a remarkable contrast in the effect of the ball striking the body of one of the long bones. This and the two following

E

lowing

lowing figures lead to a very important discussion, upon the propriety of amputation; in such cases see page 37.

Fig. 2. Necrosis of the humerus, the effect of gun-shot fracture.

Fig. 3. The sequestra or old bone drawn out.

Fig. 4. Two of the dorsal vertebræ. A ball is seen to have pierced the body of the vertebra, and to have been stopt by the ligament or fascia longitudinalis.

PLATE IV.

Fig. 1. The humerus fractured by gun-shot.

Fig. 2. The head of the same bone. We see that the ball has shattered the bone into twenty pieces, and riven the shaft. See Plate VII. and page 39.

Fig. 3. The clavicle and scapula. — The clavicle was broken by the ball, which then passed into the chest, and broke the ribs behind and stuck in the scapula. But here also the ball had penetrated the bone, and was resisted by the ligamentous connections. See further, Plate XIII.

PLATE V.

This plate represents a man wounded through the chest. The ball entered from behind and came out by the wound here represented. This was evident from the beginning, by the discharge of frothy blood from the mouth; but although he was in great danger, he is now recovering. This case stands in contrast with the next, and with that of the officer, Plate XIII.

PLATE VI.

This man received a ball in the same part of the back with the last-mentioned patient. He seemed in great distress; his breathing was affected; his account of his feelings on receiving the wound was very confused; and it was supposed that the ball had entered the chest. By and bye, a blush of redness was perceptible on the fore part of the chest;

chest; an abscess formed here, indicating the place of the ball. The abscess being opened, the ball was actually found; but the probe, in place of entering the chest, was found to take a course over the shoulder. So that it was proved to be a *superficial wound*. The ball had struck the rib, glided upwards, and turning over the shoulder, still coursing under the integuments, it lodged at last at the point opposite to where it entered.

PLATE VII.

This man received a musket ball in the shoulder; the ball entered by this wound, and came through behind, shattering the head of the humerus in its passage. The head of the bone is represented, Plate IV. fig. 1. and 2. This man's arm was amputated at the shoulder joint, and he did well. I entered fully into the merits of the case, admired the decision and the dexterity of the surgeon, and thought it one of the points of military surgery determined—that in such circumstances we should amputate. A calm consideration of this and other cases, has convinced me that this ought not to be the rule of practice. See further, page 39.

PLATE VIII.

This sketch was intended to represent that state of fistulous ulceration which attends such a fracture of the humerus as we have in Plate III. fig. 1 and 2. when the arm is preserved. He was a very stout and intrepid looking fellow. He was charging with the bayonet when his musket was knocked out of his hand as he thought; but he found that the ball had struck the arm, and that the bone was broken. We may perceive two holes in the arm; these are not the wounds made by the ball, they had long since healed, but these are the sort of ulcers which open from time to time, discharging small pieces of bone, and all that darker part which is around the holes marks the extent of new skin from an extensive ulceration which had

E 2

recently

recently healed at the time this drawing was taken. There is a small painting in the museum which gives a better representation of the ulcer which attends the necrosis of the humerus from gun-shot fracture. It occurred in a patient after I had made this etching.

PLATE IX.

This sketch also represents the effect of gun-shot fracture of the humerus.

This boy had suffered a great deal by swelling of his arm, abscess, ulceration, and the discharge of many small pieces of bone. Three marks are distinguishable upon his arm, A, B, C. The scars of former ulcerations which came in succession after fever, great swelling, abscess, and bursting out of matter. The swelling had subsided, the ulcers were dry, no bones had been discharged for some time, when unexpectedly, soon after he was sent to town, he was seized with fever; the swelling recommenced with great pain; the ulcer opened into a large efflorescence, and that irregular part here represented (D.) is a large fungous irritable sore.

This is an example of cases which has led me to some important disquisition, see page 41.; all this suffering comes of an improper method of treating gun-shot fractures of the long bones.

PLATE X.

Fig. 1. Represents the swoln state of the leg with suppurations among the muscles of the leg in consequence of the ball sticking in the head of the thigh bone; the bone is represented Plate II. fig. 1.

Fig. 2. Represents the capsule of the knee opened by a ball, the knee in consequence full of pus.

PLATE XI.

PLATE XI.

I took this sketch to exhibit the effects of a ball lodging in a long bone. We see how the whole limb is swollen; and so it will be until extensive suppurations destroy the substance of the limb, unless the inflammation is prevented rising. The limb was amputated, and the bone is represented, Plate II. fig. 2. Here the forceps were introduced to extract the ball; but it was not the ball which was felt. A represents the bag of a great abscess, which formed among the muscles: the knee joint was full of pus.

PLATE XII.

Fig. 1. Represents a gun-shot wound, where the head of the ulna was struck. The arm was amputated: it might have been saved.

Fig. 2. The representation of the wound mentioned page 21. The ball entered at A, came out at B, entered again at C, and was cut out at D.

PLATE XIII.

Sketch of the body of ———. The ball broke the clavicle of the first rib, passed into the chest and through the lungs, broke the fifth rib, and stuck in the scapula. See Plate IV. fig. 3.

This gentleman survived the first danger of suffocation from blood escaping into the cells of the lungs, and into the trachea. He also bore the first rising of the inflammation; but died on the twelfth day, from the extent of serous effusion in the thorax. When I made the incision into the chest, the fluid spouted out, and continued to flow as from a cask. All the upper part of the lungs of the left side, were of a liver-like firmness, from extravasation and inflammation.

THE END.

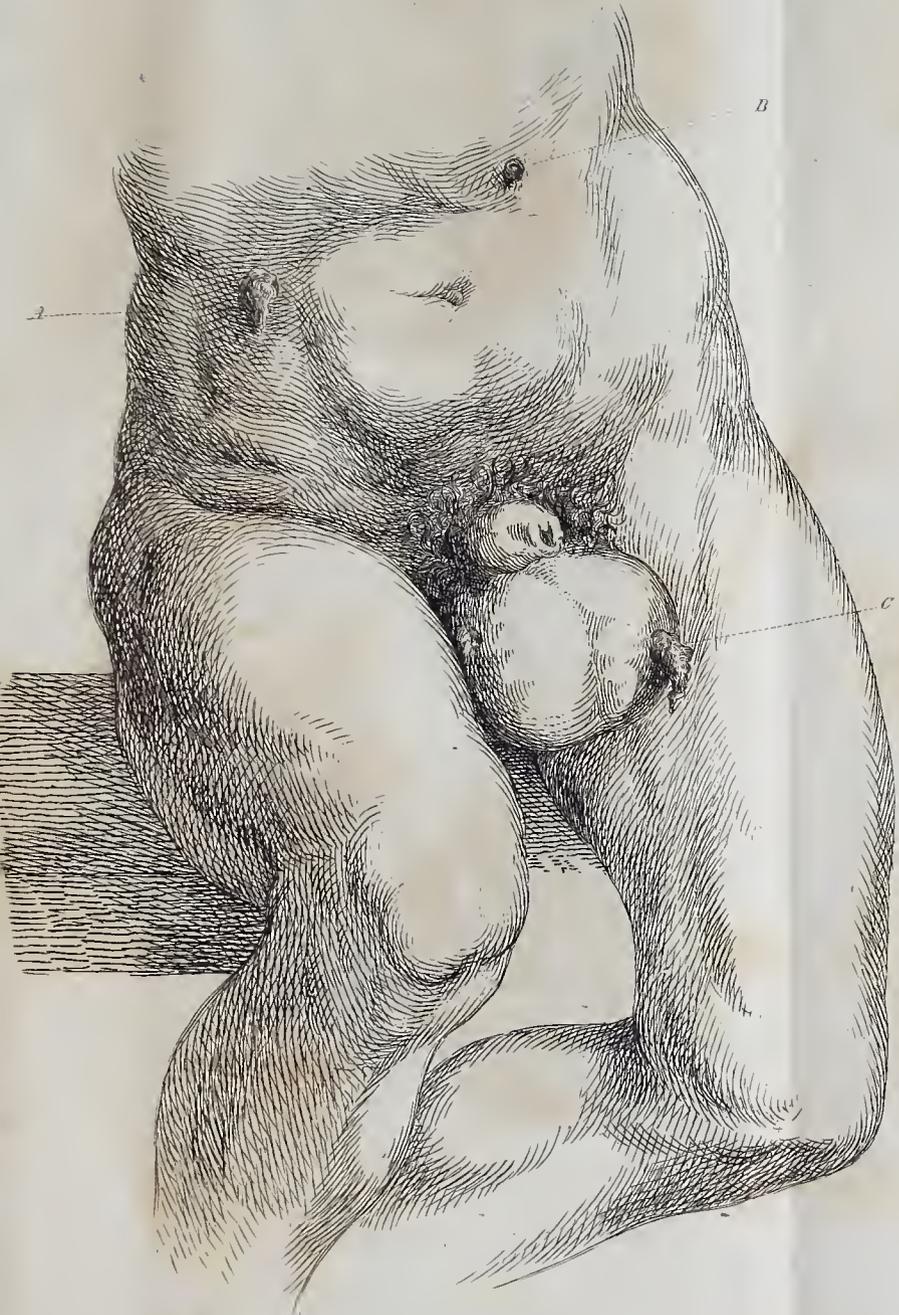


Fig. 1.

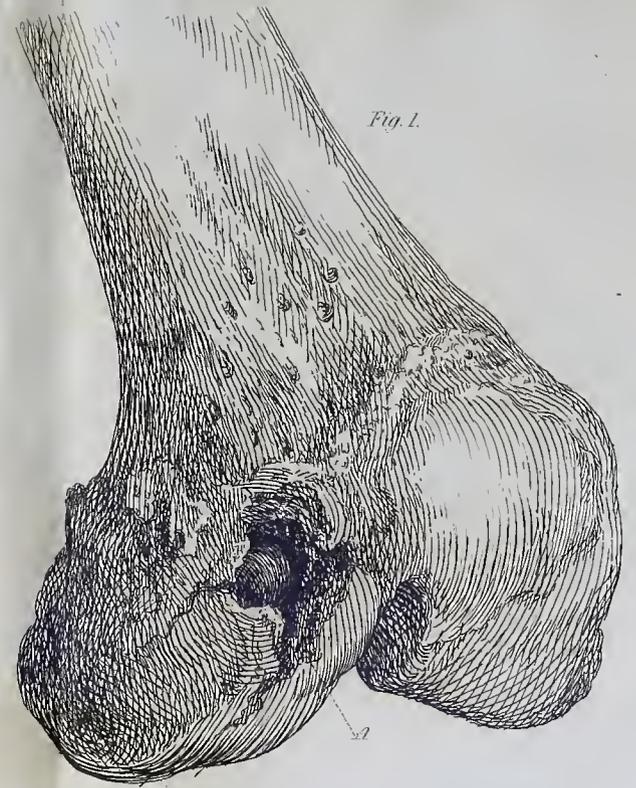


Fig. 2.



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 1.



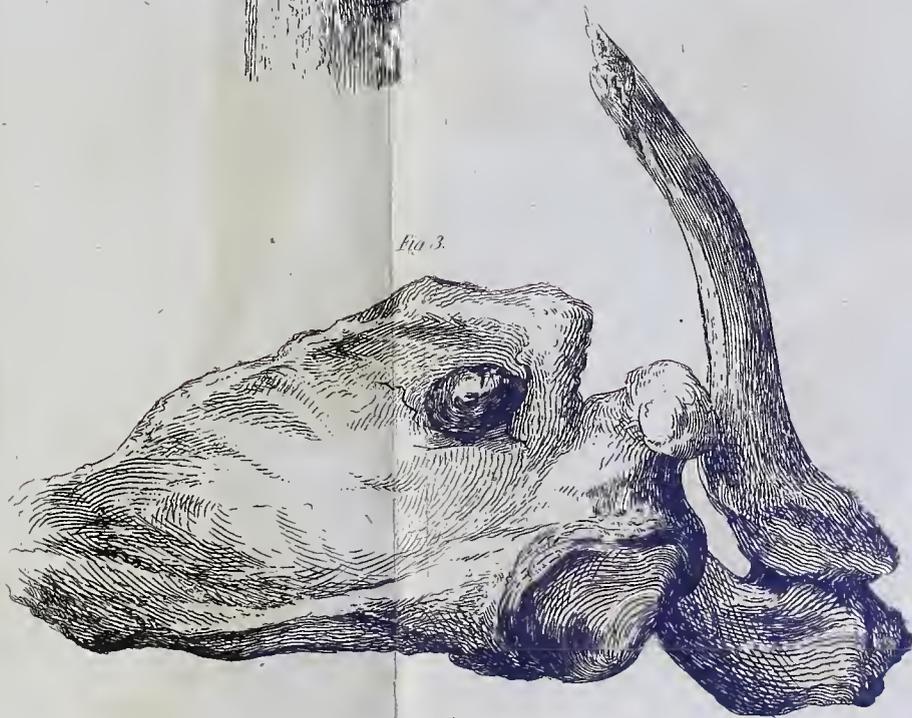
Fig. 1.



Fig. 2.



Fig. 3.





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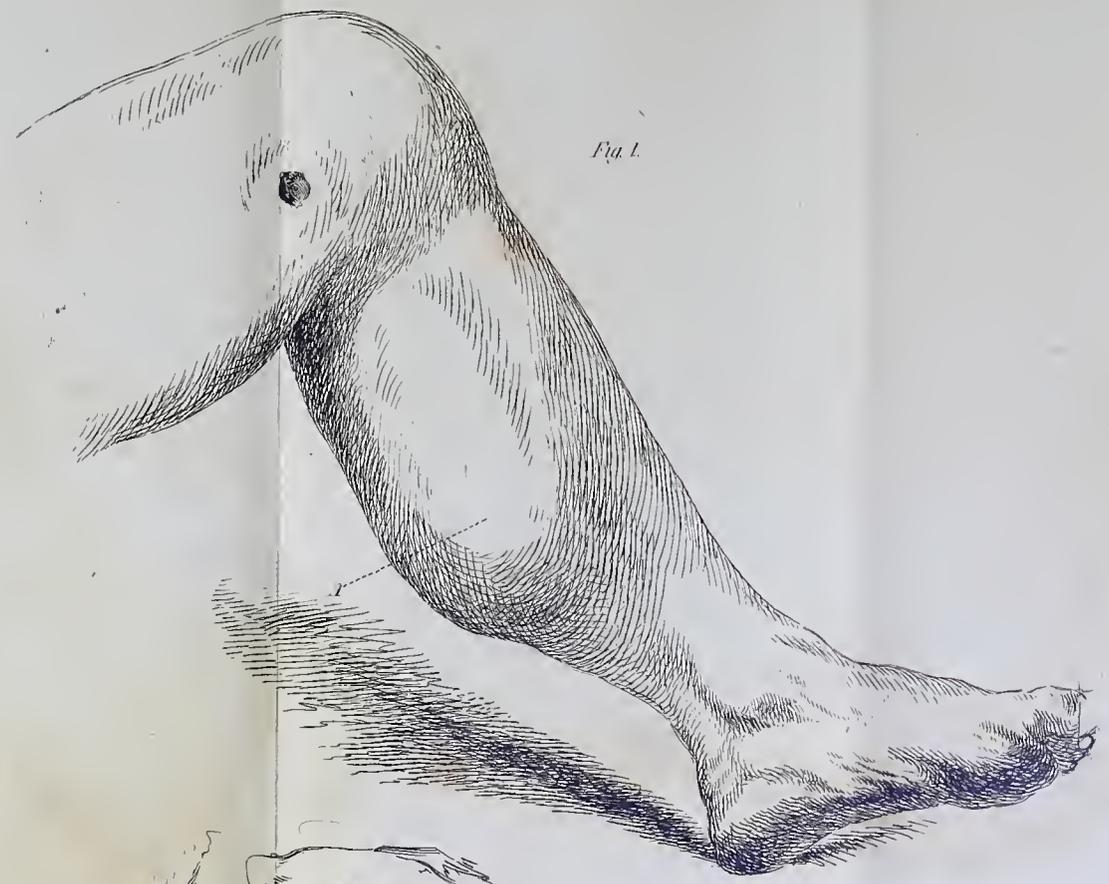
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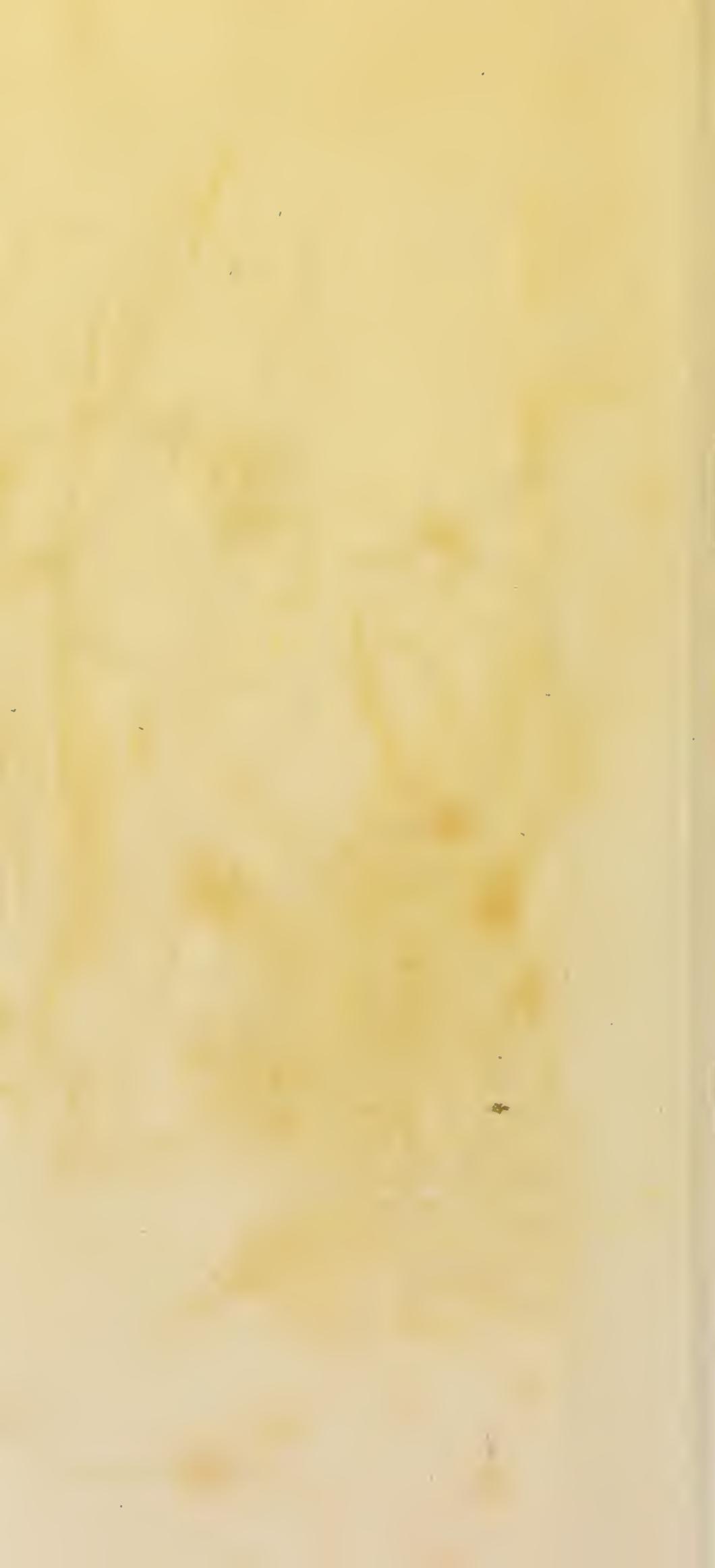


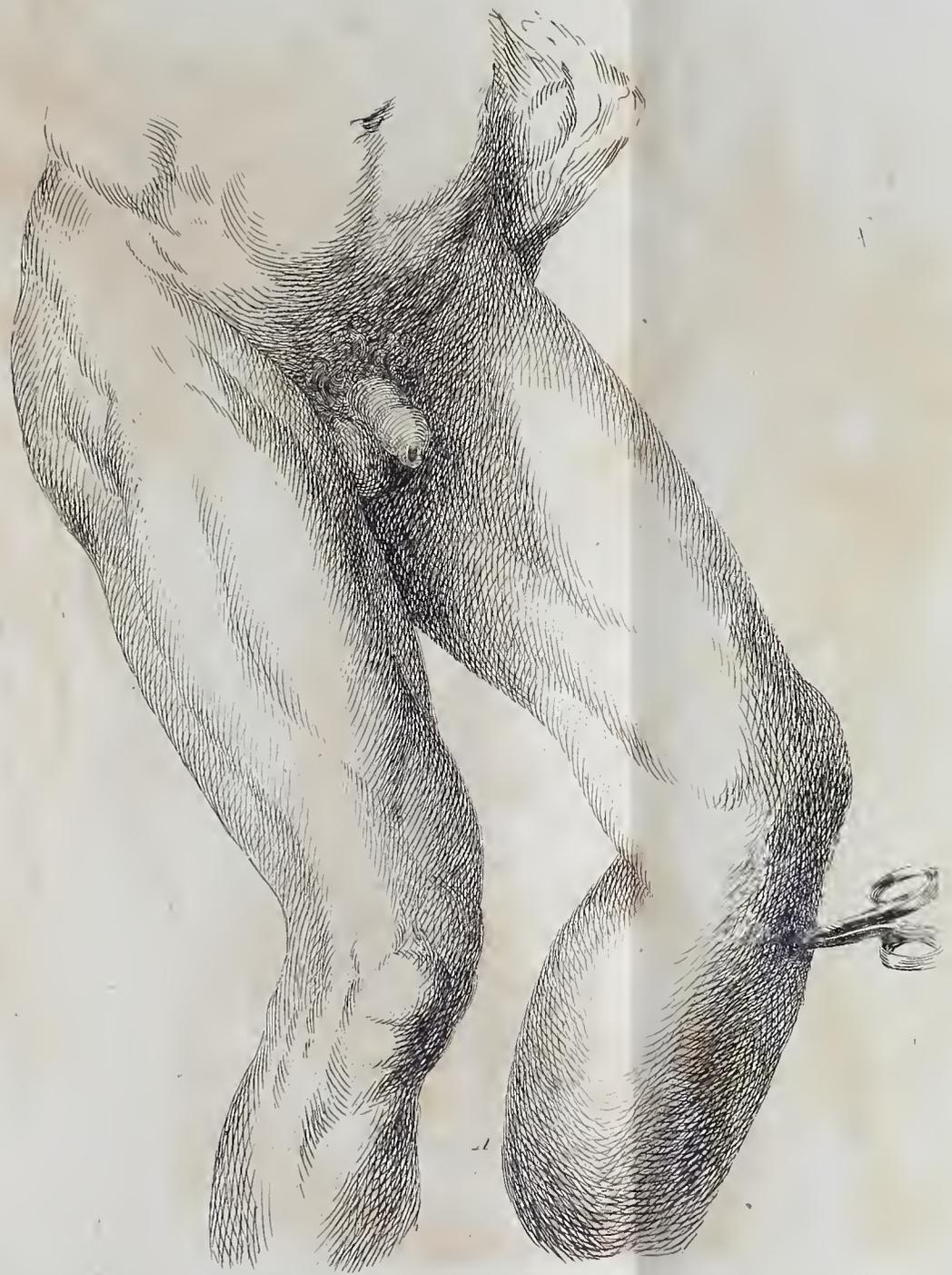
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Fig. 1.

Fig. 2.

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